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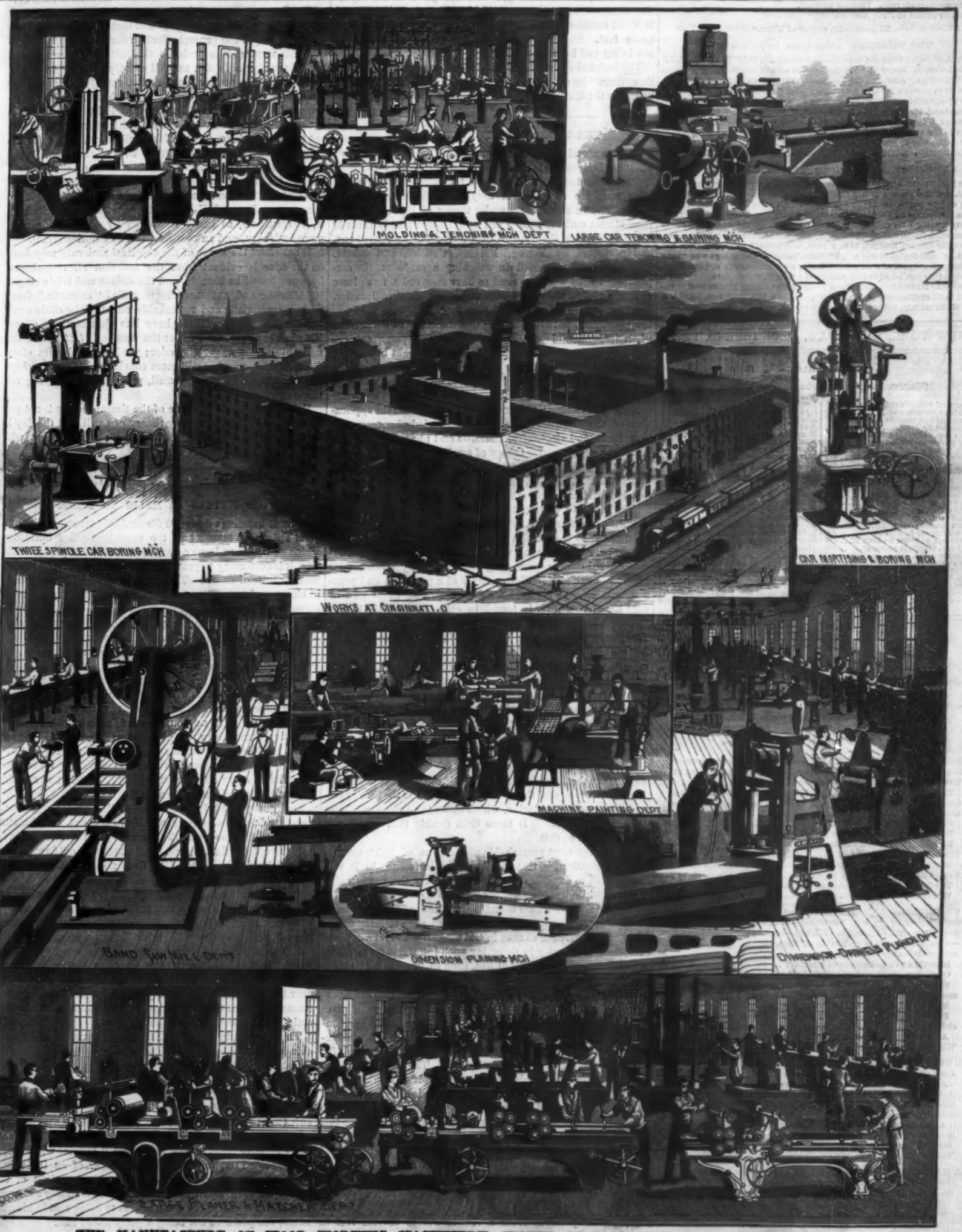
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THE EDISON ELECTRIC LIGHT.

The difficulties encountered by the Edison Light Company in the development of their public system in this city appear to be serious as well as perplexing. The main difficulty, arising from the lack of unison in the working of the engines, seems to have proved insurmountable except by a change of plan. The president of the company tells the *Post* that it has been determined to replace the engines of the central station by others, one of which is already in position. The experiments made to overcome the defects of the first battery of engines have retarded the work, he says, have made the light uneven, and severely tried the lamps; yet there has been no break in the service, which has been extended from 85 houses with 2,000 lamps to 226 houses with 5,053 lamps, with an average of 3,000 lamps in constant use.

A change has also been made in the price of the light. The charge is now at the rate of $2 an hour for a light equal to 2,000 candles, or about the cost of gas at $3 a thousand cubic feet. Meters for the registry of the current used are being put in as fast as they can be made and tested.

The isolated system has been more successful than the public system. In a year and a half, 154 plants have been established in the United States, employing 29,192 lamps.

THE UNDULATORY THEORY OF ODORS.

The immortal Newton, in common with other savants of his time, believed that light consisted of minute particles emitted from luminous bodies and traveling through space with immense rapidity till they reached the eye. This theory, known as the corpuscular theory of light, has since been almost entirely abandoned by scientific men in favor of the "undulatory theory," so ably advocated by Huyghens, and perfected by Young, Fresnel, Cauchy, and others. When Crookes succeeded in weighing a sunbeam, the corpuscular theory was supposed to have received a fresh lease of life, as better able to explain the action of the radiometer. But the disciples of the undulatory theory soon rallied from the blow, and, notwithstanding the difficulty of conceiving of an imponderable ether, omnipresent and persistent, the undulatory theory still prevails. Not only light but heat is now explained as a form or mode of motion, and the whole phenomena of gases are now explained on the kinetic theory, which has motion for its basis.

Notwithstanding the success that has attended the application of the undulatory theory to the varied phenomena of heat, light, and electricity, chemists and physicists still adhere to the corpuscular theory of smell, and teach that odor is due to small particles thrown out from the odoriferous body. A phenomenon that goes far to disprove this assumption is seized on by chemists to illustrate the smallness of the molecule and by physicists to prove the (almost) infinite divisibility of matter. A few grains of musk will impart a strong odor to the air of a room for years without suffering any appreciable loss of weight. Other instances of non-volatile substances possessing a remarkably strong odor might be cited; a familiar example of a powerful and penetrating odor from a liquid with high boiling point and of very slight volatility is found in carbolic acid, the loss of volume by evaporation being entirely out of proportion to the odor. On the other hand, the fact that many volatile liquids are odoriferous does not prove that it is the particles of liquid or vapor which, coming in contact with the organs of smell, produce the well known phenomena, for there are volatile substances innumerable which have little or no odor. The elementary gases, with the exception of chlorine, are without odor, and many of the compound gases, such as nitrous oxide and carbon dioxide, are void of odor when pure.

Dr. W. Ramsey, of England, has recently called attention to the fact that the lower the specific gravity of a gas the less odor it has, and this we find confirmed in the case of elementary gases by chlorine, which alone is odorous, while its specific gravity (85·5) is more than double that of oxygen (16) or nitrogen (14).

One of the most remarkable phenomena of light, excepting polarization, is that known as "interference." It was impossible to explain this satisfactorily on the corpuscular theory, while it was easily accomplished on the undulatory theory. Sound, which is due to vibrations of the air so large as to be easily observed, does not afford such striking examples of interference as seen in the case of light, yet a delicate ear has no difficulty in detecting such interference in many of the commonest affairs of life, such as two clocks ticking, the interference between musical notes, etc.

If smell depends on vibrations of any sort, it must be possible to detect cases, however rare, of interference. There are familiar instances where one strong odor masks and conceals another, as also of substances of unlike odors combining chemically to produce odorless ones, but it is doubtful if these are true cases of interference. The observation recently made that quinine destroys the odor of musk deserves a closer study to determine whether this is not due to interference, just as red and green light produce white. We do not even know as yet whether odorless substances owe this property to absence of vibrations, or, as in the case of light, to vibrations too long or too short to be taken cognizance of by our olfactory nerves. It is well known that light-waves shorter than the violet or longer than the red produce, on the optic nerve, the sensation of darkness. The range of the eye is scarcely one octave, while the ear distinguishes sounds produced by waves from a few inches to several feet in length, including several octaves. What length of waves are able to affect the olfactory nerves we are not yet able to determine, nor do we know whether disagreeable smells are caused by undulations of greater velocity than pleasant ones, or the reverse. It is probable that each odor consists of several separate and elementary notes; that when these are harmoniously combined the result is agreeable, and that vile odors are simply the result of discord.

One fact may be of use in the study of the undulatory theory of odors: that sunlight causes sneezing, even in the blind, while certain odors produce a like effect.

The difficulty in the way of investigating the subject of smells is the lack of any instrument for measuring odors, all depending as yet on unreliable senses, and all observations being subject to a very large discount for "personal error." When a spectroscope for analyzing odors shall have been invented, it is not unlikely that we shall find certain lines corresponding to certain elements, each being so modified by the other elements in the compound that it is not possible to distinguish it in the general effect on the olfactories. However this may be, it is probable that nitrogen, arsenic, and phosphorus (pentads all), as well as sulphur and selenium, will be found to possess some peculiar modifying power over the others. Perhaps it will be found that simple bodies vibrate only in one plane, like polarized light, but not all in the same plane; that when two elements vibrating in different planes combine, the resulting vibration, being the resultant of two forces, differs from both of them, and hence the odor of the compound differs from that of each constituent. One of the most remarkable and familiar cases of this sort is where odorless nitrogen and hydrogen combine to form ammonia gas, NH_3, with its penetrating odor, which is, nevertheless, so easily destroyed by combination with more hydrogen, and an equal volume of chlorine (HCl).

What effect the shape of the chemical molecule may have on the odor is evident from the fact that all ring-shaped hydrocarbons like benzole, and the double and triple ringed naphthaline and anthracene, are called "aromatic," from their characteristic and remarkable odors. The chain compounds, like the paraffines, have less characteristic odors; but of either class, the greater the number of atoms in the molecule the stronger the odor; yet isomeric bodies often differ in odor, proving still more conclusively that the *shape* of the molecule affects the smell, probably by changing the plane of vibration.

Perhaps we are in advance of the times; the age is not yet ripe to accept the undulatory theory of smell, but the day is not so far distant when discoveries will be made that will establish and sustain our views.

E. J. H.

GAS METERS AS HELPS TO FIRES.

In most buildings designed for multiple tenancy, like our great apartment houses and the capacious office buildings which comprise so large a part of the business part of this city, it is customary to provide a separate gas meter for each room or suite of rooms. These meters are commonly placed in closets and out of the way corners, and are very apt to be surrounded with much combustible matter.

The connections of meters with the gas pipes are usually, if not always, of lead, a metal that is easily fusible, and the solder with which the plates of the meter are joined together yields even more readily to heat.

Let a fire break out in a building containing, as many buildings do, a score or more of these fragile fire feeders, and the hot air sweeping in advance of the fire will quickly melt the lead or solder. The outpouring gas fills the building with an explosive atmosphere which hastens the spread of the flames, and keeps up an inexhaustible supply of fuel. Such burning gas jets, sometimes of great size, are to be seen after almost every city fire, when nothing is left of a building but blackened and broken walls.

The gas poured into burning buildings through such openings doubtless helps materially to account for the surprising suddenness with which many great buildings have been swept by flames; and in all cases the outflow of gas must seriously counteract, if it does not altogether thwart, the efforts of the firemen.

The remedy for this great evil is not so easy to point out. It is obvious that where a multitude of meters are to be distributed through a building, they should be more securely incased, and provided with infusible connections; or some means should be devised whereby the gas supply shall be automatically shut off whenever the temperature rises so as to imperil the integrity of the meter. There should also be near the outer door and readily accessible to firemen some means by which the connection of the house with the gas main in the street can be quickly closed.

There is clearly an opportunity here for useful and profitable invention.

A Licensee Cannot Sue for an Infringement.

Judge Wallace, in the case of Ingalls *vs.* Tice, U. S. Circuit Court for this district, has decided that an agreement whereby the patentee granted to the complainant the sole and exclusive right to sell the patented articles within certain specified territory was not a transfer of an individual part of the whole patent or of the exclusive right of the whole patent for a particular territory. It is simply a license, and does not entitle the complainant to bring suit in his own name, the patentee not being a party to the suit.

ASPECTS OF THE PLANETS FOR JANUARY.

JUPITER

is evening star, and easily wins the place of honor on the January list, not only among his brother planets that play the same role, but also in comparison with every other star that twinkles in the sky, during his presence there.

It is true that he passed his brightest and nearest point on the 18th of December, and, since that time, has been traveling away from us and approaching the sun. But his light has not yet perceptibly paled to the eye. No one can behold him without a feeling of admiration, as he appears in the eastern sky soon as it is dark enough to see him rise with stately step to the zenith, and sinks slowly to the west, glowing in the celestial dome during nearly the whole night.

The galaxy of stars surrounding the distinguished chief is also to be noted. Among them may be easily traced the magnificent cluster of Orion, the beaming Sirius, the red stars, Procyon and Aldebaran, and the white Capella. The giant planet can find no fairer portion of the sky in which to track his wandering steps, and no more brilliant retinue to grace his court.

Jupiter plays no prominent part on the records of the month. There are specialties that distinguish each separate planet, as marked and diverse as those found in different members of the same family

The great planet, the pride of the system, seems to have a consciousness of his princely bearing, and to be contented with looking his best as he leads the celestial host, outshining them all. A vein of egotism and self-conceit are, to the eye of fancy, as apparent in his appearance as gentleness and feminine grace are in that of Venus, or a warlike aspect in Mars.

The right ascension of Jupiter is 5 h. 36 m., his declination is 23° north, his diameter is 45″, and his position in the heavens is on the border of Taurus near Gemini.

Jupiter sets at a quarter after six o'clock in the morning; at the close of the month he sets about seven minutes after four o'clock.

SATURN

is evening star during the month, ranking next to Jupiter in size and brightness among the evening stars. His soft light is now very attractive, especially in comparison with the murky hue that distinguishes him in less favored aspects, and was interpreted by astrologers as ominous of ill to those whose horoscopes were cast when he was in the ascendant, hence he was called ill-boding Saturn. If astrologers had seen this planet in a modern telescope, nothing but good fortune could have been associated with a brother world so magnificent and complex in structure.

Since September, Saturn has been apparently retrograding or moving backward, and also traveling south. Toward the end of the month, he will begin to move in a direct course or forward. The planets all travel in this way, sometimes direct, sometimes indirect, and sometimes stationary. The reason is that they are moving and the earth is moving, and this is the way they appear projected on the sky as seen from the earth, which is a moving observatory. In reality all the planets revolve in elliptical orbits round the sun, and they would appear to move in this way, if we could see them from the sun. If Saturn's position in regard to the Pleiades be carefully noted, the proof of the way in which he seems to travel will be plainly perceived.

The right ascension of Saturn is 3 h. 11 m., his declination is 15° 26′ north, his diameter is 18″, and his place is in Aries.

Saturn sets at twenty minutes past three o'clock in the morning; at the end of the month he sets at twenty-two minutes past one o'clock.

NEPTUNE

is evening star, and though taking precedence of the trio in the order of appearance above the horizon, he does not arouse the same interest because he is too far away to be visible. He is still near Saturn, there being now only ten minutes difference in the time of transit.

The right ascension of Neptune is 2 h. 57 m., his declination is 14° 58′ north, his diameter is 2·6″, and his place is in the constellation Aries.

MERCURY

is evening star during the whole month. He reaches his greatest eastern elongation on the 22d, at two o'clock in the morning. He is then 18° 32′ east of the sun, and this is one of the three occasions when he may be seen during the year as evening star. His southern declination at that time is 14° 21′, which will make it more difficult to find him. Mercury at elongation on the 22d sets about half-past six o'clock, an hour and a half before the sun, and will be visible for a week before and after that time. He must be looked for in the southwest, three quarters of an hour after sunset, and 5° north of the sunset point. Fine views of Mercury are often obtained in the clear winter evening sky, but there must be no clouds around the horizon, or he will fail to appear.

The right ascension of Mercury is 19h. 21m., his declination is 24° 17′ south, his diameter is 4·8″, and he is in Sagittarius.

Mercury sets about a quarter after five o'clock in the evening; at the end of the month he sets at ten minutes after six o'clock.

VENUS

is morning star, and will continue in this role until the 20th of September, when she is in conjunction with the sun. She has lost the prestige that attended her movements before and during the transit, and has returned to the rank of an ordinary planet, the most beautiful one, however, that graces the sky.

She makes a superb appearance now in the eastern morning sky, rising nearly three hours before the sun, and being far more worth getting up to see than the fading comet. Every one should endeavor to behold her shining face near the 9th of the month. She then reaches her period of greatest brilliancy on the western side of the sun. She has two of these periods, one thirty-six days before inferior conjunction when she is evening star, and the other, thirty-six days after inferior conjunction, when she is morning star. In the former case, seen in the telescope, she takes on the aspect of a waning crescent, like the old moon; in the latter, as at present, she is a waxing crescent, like the new moon.

On the 19th, Venus is in conjunction with the star Eta Ophiuchi, being 2° 21′ north. The stars will be nearest at eleven o'clock in the evening, but they will be sufficiently near to make an attractive picture on the morning of the 20th, when Venus rises not far from four o'clock. If Jupiter is prince of the evening stars, Venus is queen of the morning stars, only needing one condition, that of being farther north, to present her fairest and brightest phase.

The right ascension of Venus is 16 h. 27 m., her declination is 17° 4′ south, and her diameter is 48·6″.

Venus rises about a quarter before five o'clock in the morning; at the end of the month she rises a few minutes after four o'clock.

MARS

is morning star, but moves at a slow pace and keeps near the sun. He is of little account at present, excepting to those who wish to keep track of his course.

The right ascension of Mars is 18 h. 21 m., his declination is 24° 6′ south, his diameter is 6″, and he may be found in Sagittarius.

Mars rises nine minutes after six o'clock in the morning; at the end of the month he rises not far from half-past six o'clock.

URANUS

is morning star, although he rises before midnight. Like all the outer planets, he is morning star from conjunction to opposition, a goal that he will reach in March. His right ascension is 11 h. 37 m., his declination is 3° 21′ north, and he may be found in Virgo.

Uranus rises about a quarter before eleven o'clock in the evening; at the end of the month he rises about half-past eight o'clock.

THE MOON.

The January moon fulls on the 23d at thirty-one minutes past 2 o'clock in the morning. The old moon is in conjunction with Venus on the 6th, passing 3° 5′ south. Planet and crescent, if not very near, will be fair to see on the morning sky. On the 8th, the moon is near Mars, but both are invisible. The new moon of the 9th pays her respects to Mercury on the 10th, and draws near Neptune and Saturn on the 17th. She passes 2° north of Jupiter on the 19th, and is at her nearest point to Uranus on the 27th.

The moon is in perigee or nearest to the earth on the 13th, and the moon "runs high" on the 19th. The winter nights will be superb about this time, for the moon, rising high in the heavens, near the full, and near the brilliant Jupiter, will, on cloudless nights, flood the frost bound earth with silvery light. At such times she is so radiantly beautiful that we can forgive her for paling the luster of the stars.

THE MODIFIED INSTINCTS OF A BLIND CAT.

BY H. C. HOVEY.

The family favorite whose misfortunes have afforded an opportunity to observe the workings of instinct under difficulties is a noble specimen of the genus *Felis*. "Dido" is his name—given for simple euphony, without regard to gender. During the four years of his life he has never been known to do anything wrong, unless it be to fight most desperately against all feline intruders. In some one of his many encounters, Dido met with an injury to one of his feet that made a surgical operation necessary, from which he recovered, but shortly afterward went totally blind. A cataract was formed over each eye, by which, as repeated experiments proved, vision was thoroughly obscured.

This calamity came on suddenly, and placed the cat in circumstances not provided for by the ordinary gifts of instinct. What to do with himself was plainly a problem hard to be solved. He would sit and mew most piteously, as if bemoaning his condition; and when he attempted to move about, he met with all the mishaps that the reader will be likely to imagine. He ran against walls, fell down stairs, stumbled over sticks, and when once on the top rail of the fence he would traverse its entire length seeking in vain for a safe jumping off place. On being called, he would run about bewildered, as if not knowing whence the voice came nor whither he should go to find the one calling. In short, Dido's life seemed hardly worth living, and we were seriously plotting his death, when the cat himself clearly concluded that he must make his other senses atone for the loss of sight.

It was very curious to watch his experiments. One of the first of these was concerning the art of going down stairs. Instead of pawing the air, as he had been doing on reaching the top step, he went to one side till he felt the banisters touch his whiskers, and then, guided thus, he would descend safely and at full speed, turning into the hall on gaining the last step. One by one he made each familiar path a study, determined the exact location of each door, explored anew all his old haunts, and seemed bravely resolved to begin life over again. The result was so unexpectedly successful that we were deceived into the notion that sight had been restored. But by placing any obstacle in the path, and then calling him eagerly to his customary feeding place, it was evident that he was entirely blind, for he would run with full force against the box or other obstruction, and then, for some time afterward, he would proceed with renewed caution.

Dido's "voice is still for war," and his blindness does not make him any less successful in his duels with intruders. He even goes abroad in quest of adventures, and comes safely home again.

His value as a mouser does not seem to be in the least diminished. One of my experiments as to his capacity in this direction came near costing me dear. I had heard the gnawing of a rat in an old closet where there lay a quantity of newspapers. Here it was decided to leave Dido over night, and while arranging the papers for that purpose, my hand was suddenly caught by the claws and teeth of what at the moment seemed like a small tiger. Poor Dido! He really looked ashamed of his blunder in mistaking my hand for his anticipated victim. Fortunately the papers served as a shield, or the injury inflicted might have been more serious. I may add that, on opening the closet the next morning, there was Dido mounting guard over a slain rat as big as ever spoiled good provisions or tried a housekeeper's temper.

It is well known that the house-cat will find its way back from distant places to which it has been carried blindfolded; and how it performs such feats naturalists have never satisfactorily explained. The theory accepted by some of them is that the animal takes note of the successive odors encountered on the way, that these leave as distinct a series of images as those we should receive by the sense of sight, and that, by taking them in the inverse order from that in which they were received, he traces his homeward route.

But, in the cat now described, the sense of smell is by no means acute, as has been proved by a variety of methods; and moreover, although, as one might say, perpetually blindfolded, he quite uniformly chooses the shortest road home, without reference to the path he may have taken on leaving the house. Curious to see how far this homing instinct would extend, I took advantage of a fall of snow that wrapped under its mantle every familiar object, concealed all the paths, and deadened every odor and sound. Taking Dido to a considerable distance from the house, and making a number of turns to bewilder him, I tossed him upon a drift and quietly awaited results. The poor creature turned his sightless orbs this way and that, and mewed piteously for help. Finding, at length, that he was thrown entirely on his own resources, he stood motionless for about one minute, and then, to my amazement, made his way directly through the untrodden snow to the house door—which, it is needless to add, was promptly opened for the shivering martyr to scientific investigation, to whom consolation was forthwith offered in a brimming bowl of new milk.

My conclusion, therefore, is that Wallace's ingenious theory of accounting for orientation by what he calls "brain registration," will not explain what has been described; but that the mysterious homing faculty is probably independent of such methods of gaining knowledge as have been ordinarily observed, and is analogous to the migratory instinct controlling the long flights of some species of birds.

The Last of the Year.

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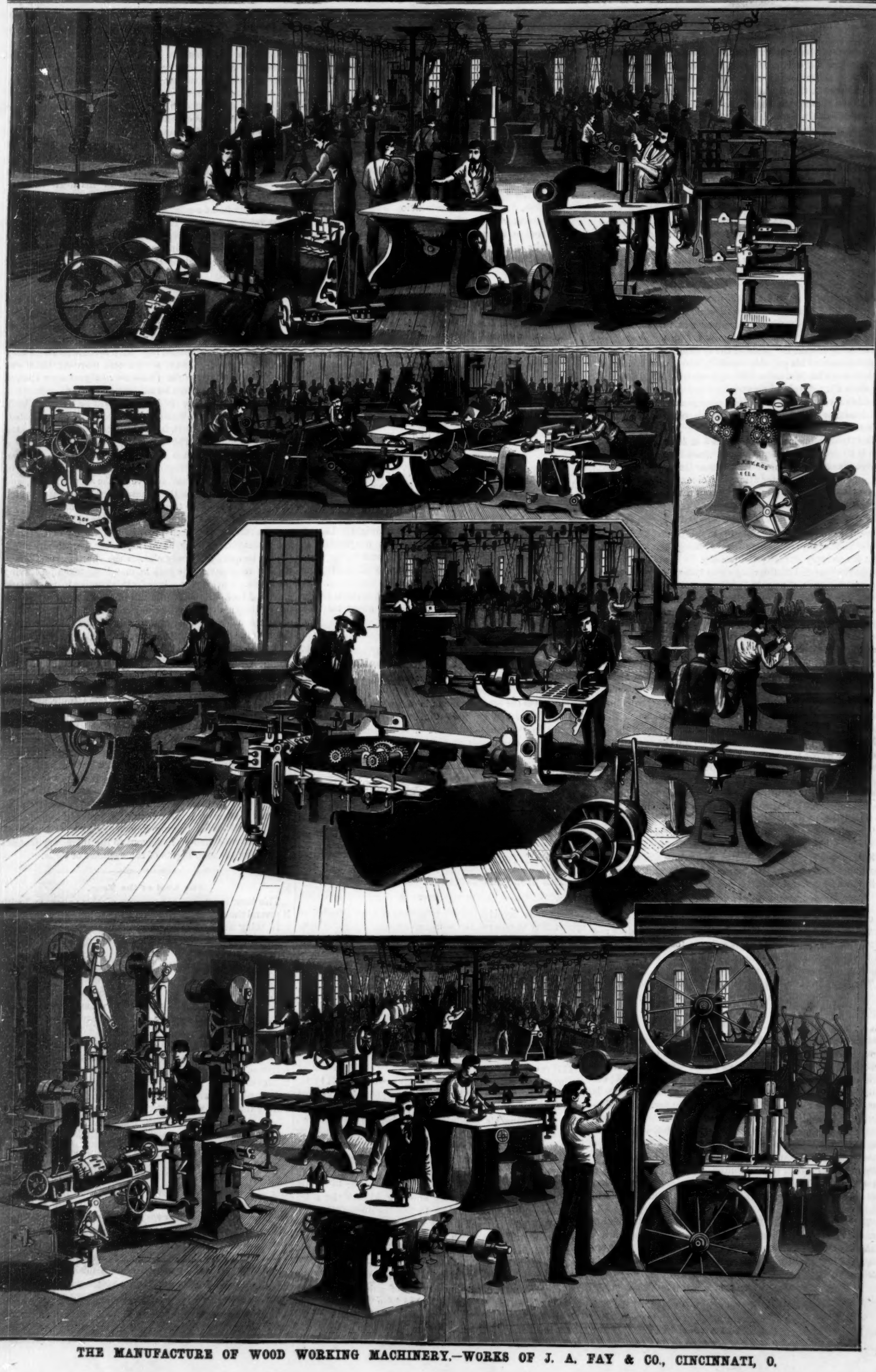
It would be a weekly reminder of the donor's generosity during the entire year 1883.

Mails Burned.

On the 21st of December, one of the postal cars bound west, on the New York Central Railway, was destroyed by fire. It is estimated that upward of fifty thousand letters and many thousands of newspapers from this city were lost. Among the latter, doubtless, were copies of the SCIENTIFIC AMERICAN. Should any of our subscribers miss a number, they will know the reason; and if they will send us a postal card, we will at once supply them. Those, also, who fail to receive expected answers from us to their letters, by reason of this mishap, will oblige us by informing us of the fact, and we will write again.

M. NORDENSKIOLD maintains that the aurora is a permanent phenomenon in polar regions, being always seen when the sun is below the horizon and when the moon is invisible.



THE MANUFACTURE OF WOOD WORKING MACHINERY.—WORKS OF J. A. FAY & CO., CINCINNATI, O.

AMERICAN INDUSTRIES.—No. 85.

THE MANUFACTURE OF WOOD WORKING MACHINERY.—J. A. FAY & CO., CINCINNATI, O.

In any review of the growth and progress of a great manufacturing house during a period of nearly a half century, much that is interesting and suggestive must of necessity be omitted, and many things treated superficially.

A brief history of the house whose name heads this article is illustrative of the progress of this country, especially in respect to its manufacturing industry in every branch of business connected with the manufacture or use of lumber. In no department of mechanics has the advancement been more rapid and the improvements more radical than in the machinery for working wood. Up to the beginning of the last quarter of the eighteenth century, the wood worker, with the ax, adz, pit saw, chisel, and rasp, did his work, and it may be said that, with the exception of a few saw mills, there was in that day no machinery for working wood. That saw mills were rare at that time may be gathered from the fact that one established in Limehouse, in the western district of London in 1767, was destroyed by a mob of sawyers, who considered their craft in danger. Many of the old residents of this country distinctly recollect when logs and tree trunks were sawed from end to end, to work them into dimension stuff, by two sawyers, one standing on the log and the other in the pit beneath with a veil over his eyes to protect them from sawdust. These sawyers were truly hard workers. The top sawyer, while he swung his weight upon the handles above, invariably bossed the wretch in the hole who pulled down.

Now there are hosts of saw mills of various kinds in all great lumber centers of the country. They are driven by steam and water power in gangs on the most gigantic scale, and there is no end of wood working machinery in use in manufactories, also machines for special work in all cities where the stuff thus roughly "got out" into square stuff or merchantable lumber is sawed into plank, dimension lumber, slats, veneers, and worked into thousands of forms.

In the invention, manufacturing, and introducing of wood working machinery, J. A. Fay & Co. have been the pioneers; their name is known all over the world, and their machines are in use in every land. They are still as full of the pioneer spirit as ever, being constantly on the alert to accede to the demand of the times by introducing everything new or useful in their department of manufacture. This business, which has made the name of Cincinnati known at the remotest corners of the earth, was not built up in a single day. Its growth has been like that of the oak from the acorn, slow but sure, until its trade and trade ramifications are enormous. Successive years only add to and increase its volume.

We present to our readers an engraving of the extensive plant of this house, with an inside view of a few leading departments, together with facts of its history, which will be to many very interesting. (See our first page.)

In 1834, George Page, of Keene, N. H., invented and began the manufacture of foot mortising machines. These were the first machines of the kind made in this country, if not in the world.

In 1835, Mr. J. A. Fay, of Marlboro, Mass., associated himself with Geo. Page, and under the firm name of Page & Co., Mr. Fay introduced the Fay tenoning machine for tenoning and coping doors, sash and some other wood-working machines. The country was not then opened up by railroads and was sparsely settled, and Mr. Fay found a market for his machines by taking them in a wagon over the hills and through the valleys, introducing them in various sash and door shops.

These machines were so wonderfully labor-saving, as compared with the old tedious and laborious hand process of working, that it was but a short time before their merits became established, and a rapidly increasing trade followed. In the mean time, Mr. Edward Joslin, of Keene, N. H., who had been in the employ of the company as a workman from the beginning, joined with Mr. Fay, and bought out the business of Page & Co. He was of a quite inventive turn of mind, and from this time the firm introduced various labor-saving wood working machines. This was in 1841. In 1848, their business having increased beyond the capacity of their works, they started branch manufactories at Worcester, Mass., and at Norwich, Conn. In the manufactory at Norwich, Mr. C. B. Rogers, now deceased, had a large interest and was the resident partner. The business increased rapidly and steadily, until, eleven years later, or in 1852, the enterprise was so great that they felt they must have a Western connection.

This was before there were railroads traversing the West and Southwest, as now; and in this year they established, at the corner of Augusta and John Streets, Cincinnati, another branch house of J. A. Fay & Co., with Mr. John Cheney and Mr. E. Reed as resident partners. Later in the same year, while Mr. Fay was in Richmond, Va., with a view of establishing a branch house in the South, he died. In 1855, his executors sold out his business at Norwich to C. B. Rogers & Co., and later, in 1862, discontinued the Worcester house, and still later, in 1863, discontinued the parent house at Keene, N. H., transferring most of the important machines to the Western house at Cincinnati.

In 1861, 21 years ago, Mr. Cheney retired, and Mr. W. H. Doane, who had been several years with the company, became the leading member of the house and manager. Its history during these 21 years is marvelous. And to recount its progress would involve the history of Cincinnati itself. In 1860, the establishment of J. A. Fay & Co. was considered one of the largest in the West, but since that time it has more than quadrupled its size, and now it covers more than six acres of floor space, and furnishes steady employment to about 400 skilled artisans and mechanics, who, aided by the most improved labor-saving machines, are able to turn out the work of more than 2,000 men. The buildings are five stories in height and of the most substantial character, and are provided with four power elevators. The motive power is supplied by a Corliss automatic cut-off engine, which takes its steam from a battery of Babcock & Wilcox sectional wrought iron boilers of 250 horse power. Over 2,000 feet shafting and 5,000 feet of belting are in use in the different departments. The strictest system pervades the whole establishment; there are all together 15 divisions, each with its own foreman and all under the immediate supervision of a general superintendent. The foreman are especially selected from among the most skilled workmen of a department, and all vie with each other upon the general excellency of the product of their different departments, the aim of each being to excel the other.

To form a correct opinion regarding the immense number and variety of the machines made at these works, they should be visited; but for the benefit of our foreign readers, we will enumerate a few of the principal ones and the uses for which they are designed.

Of car building machines for railroad shops, they make about thirty-five different varieties. Of planing, including matching, machines, over twenty, adapted to all kinds of work, from the smallest cigar box and cabinet making machines to those for the largest possible requirements, and weighing many tons. The number of wheel and carriage making machines, including machines for making and finishing every part of the wheels and carriage, is between thirty and forty, and of sash and door machines about the same number. Of cabinet making, including furniture, machines, twenty-five or more; agricultural implement machines, about twenty-five; and bridge building machines, about twenty-five. Of band sawing machines, they build ten sizes, from the largest costing two thousand dollars with a capacity to saw a log six feet in diameter to the smallest size, costing one hundred and fifty dollars and suitable for all common scroll and curve cutting.

To describe the capabilities of the machines would require a volume, but their utility and power may be inferred from a brief description of a few. Among the more ponderous and massive are those designed for railroad car building. In fact, it may be stated that these are of a special character, particularly designed to decrease very materially the labor and cost of handling heavy timber; and to such perfection have these devices attained, that in dressing car sills, where formerly several machines were required to dress and square up fifty in a day, one machine will now do the same amount of work in an hour. The power of a large timber dressing machine is so great and its execution so precise that timbers even up to twelve inches square and of any length can be finished on all four sides at one cut at the rate of thirty feet per minute. If required, it will reduce one inch by the top cutting cylinder and the same with the heads which cut upon the sides. This, exclusive of the cut of the lower or under head, would make three inches off the surface of a timber, or equal to more than one inch reduced at one cut from a timber twenty-four inches wide. The vertical car tenoning machine, which takes the sill or timber from the machine first described, makes single, double, or triple tenons, first on one end, then on the other, without reversal. This one machine alone, it is said, saves the labor of sixty men. Another machine, the car gaining and boring machine, is capable of automatically traversing back and forth over timbers, and at each passage cutting grooves of any desired depth or width.

Stops regulate the precise distances apart, so that exact duplicates of the gains can be made in any part or number of pieces of timber without laying out. A vertical boring attachment completes the holes in the timbers for joint bolts while it is on the carriage of the machine, thus saving the labor of additional handling and separate machines. This machine is capable of doing the heaviest class of work required. Heavy mortising and boring machines are constructed that will "beat" mortises up to two and a half inches in width and of any ordinary depth, the peculiarity of which is the graduated movement of the chisel bar, which commences from a still point above the upper extreme throw of the chisel mandrel, and working down gradually into the wood without jar to the operator. In this department alone are turned out machines for boring with one, two, or three spindles either vertically, horizontally, or radially, that will finish a piece of timber in from four to five minutes. In all these machines, the quality as well as the quantity of the product are the leading features attained, and these remarks will apply with equal force to every class of machines made in the factory, regardless of the grade of work for which they are intended. Had we space, we might extend our review of the capabilities of the different machines to an unlimited extent. It is, however, a fact that the largest variety of machines for wood working purposes to be found in any manufactory in the world is made at this establishment, and its facilities rank it among the most extensive establishments of the kind in the world. To this house the manufacturers of the United States look for their best equipments. Here, furniture makers, wheel and carriage makers, planing mill owners, and other users of labor-saving wood working machinery look for the highest standard of excellence and perfection. The striking originality of the machinery, possessing as it does all that is desirable in accuracy of workmanship, precision of action, strength of construction, solidity, and uniformity, has attracted not only the attention of manufacturers, but also the executive departments of foreign governments, who have given the firm many orders.

The house of J. A. Fay & Co. have many established agencies and correspondents throughout the world. The following is a partial list of their principal representatives:

Messrs. Cayley & Cayley, Brackley St., Golden Lane, London, are the agents for Great Britain and Ireland. The same extensive house has also a branch in Hamburg, and are also agents for Germany, Austria, Norway, Sweden, and Prussia. The well-known house of H. P. Gregory & Co., of Sydney, represent the company in Australia.

In the city of New York, the George Place Machinery Co. are the general agents. Utilles Baird, of Water St., Pittsburg, Pa., is the agent of that city. At Detroit, Mich., the house is represented by James Jenks, Nos. 48, 50, 52, and 54 Randolph St. At Chicago, the firm have a branch house at 207 and 209 Lake St., over which Mr. John A. Roche, a mechanical engineer of reputation and ability, presides.

At St. Louis, Mo., the company have their own warehouse at 720 North Second Street, under the management of Mr. C. C. Harris, well known in that part of the country. On the Pacific coast, both at San Francisco, Cal., and at Portland, Ore., the house is represented by H. P. Gregory & Co., Market Street, San Francisco, who have extensive houses at each place. The general agents have also many minor agencies under their management and jurisdiction.

Large shipments are constantly being made to Great Britain, Russia, Germany, Italy, Sweden, France, Japan, Africa, South America, New Zealand, Mexico, and other countries. In all of these countries, their machines are looked upon as unrivaled.

The many displays of machinery by this house at the international expositions have done not a little toward bringing the excellence of their manufactures before the public, especially as at all of the expositions they have received the highest awards, which was the case at Paris, Vienna, Australia, etc.

The prominence gained for this house during twenty-one years, from 1861 until the present time, is undoubtedly largely due to the most indomitable energy, sagacity, mechanical skill, and executive ability shown by its president, Mr. W. H. Doane, and Mr. D. L. Lyon, secretary, who have lived to see the business of the house increase to the most extraordinary dimensions, with its reputation extending throughout the whole earth.

Absorption of Volatile Substances.

T. Schloesing has attempted, in *Comptes Rendus*, p. 1,187 to explain the fact that when air containing hydrochloric acid has been passed through ammonia, it is filled with clouds of salammoniac vapors. He says that solid and liquid substances floating suspended in gases possess so little power of motion that they do not come into contact with the liquids through which such gases are conducted, and hence are not retained by them. This mobility, however, is attained by vaporizing the substance and converting it into a gas.

If air containing vapors of sulphuric acid is passed over common salt at ordinary temperatures, the hydrochloric acid given off always contains sulphuric acid. But if the salt is heated to 350° C. (662° Fahr.), so as to convert the sulphuric acid into vapor, it will be completely retained by the salt.

If air containing hydrochloric acid is passed up through a vertical column, and water trickles down through it continuously, the acid will not be entirely absorbed; but the solution is perfect if the temperature is raised to that of boiling water.

If air containing carbonate of ammonia in form of dust is conducted through a small tower of coke, with sulphuric acid on it, the alkali will not be completely retained by the acid until the temperature is raised to 212° Fahr. Schloesing therefore recommends heating instead of cooling as favorable to absorption.—*Ind. Zeitung.*

Coal Mining in Ohio.

In his report for the year ended last June, the State Inspector of Mines of Ohio states that the annual production of coal has increased since 1872 from 5,315,294 tons to 9,450,000 tons in 1882. The increase upon 1881 was over 1,000,000 tons. The undeveloped coal of the State is estimated at 85,000,000,000 tons. The amount mined thus far is about 70,000,000 tons. The Inspector is of the opinion that an equal amount has been wasted on account of a lack of accurate mining plans and engineering skill.

Professor Koch's Discovery Disputed.

At a meeting of the New Orleans Pathological Society, November 20, the President, Dr. H. D. Schmidt, made an important microscopic demonstration to disprove the reported discovery of Professor Koch, in Berlin, as to the bacilli of tuberculosis. Dr. Schmidt claimed to demonstrate that the bacilli thought by Dr. Koch to be the cause of tubercular consumption were simply fatty crystals. Dr. Schmidt's researches have been long and minute, and he is confident that Dr. Koch is in error.

Lead Pigments.

The manufacture of lead paint was begun in America by John Harrison, of Philadelphia, a young man, who, according to the *Glassware Reporter*, believed that a large number of chemical products which were being procured from abroad might be made here as well. Having finished a thorough education in chemistry under the celebrated Joseph Priestley, of England, Harrison started a factory of sulphuric acid and white lead in Philadelphia in 1798, and prospered from the very first. The house of John T. Lewis & Brothers, founded in 1807, afterward went into the same business. The manufacture soon extended all over the country. It became particularly successful in Brooklyn, N. Y., owing to the growth of the communities in that immediate vicinity. At the present time there are 145 factories engaged in the production of paints, the manufacture of lead pigments being a part of their business. They employ 3,000 hands, and produce $17,000,000 worth of goods annually, in average years. Of the total number, 34 are in Pennsylvania, 16 in Massachusetts, 11 in New York, 14 in Ohio, 10 in Missouri, and 4 in Illinois.

The principal pigments made from lead are minium or red lead (which is easily produced by exposing litharge at a continued low red heat to the action of the air), white lead, a carbonate of the metal, chrome red, and chrome yellow. They are all beautiful, brilliant, and valuable pigments. Oxide of zinc now contests with white lead the favor of builders; but the importance of the pigment is scarcely affected by the competition.

White lead was originally made in Holland; and invention has thus far failed to supersede the "Dutch process" of its manufacture. Some variations in the details have been made in America, but the process is essentially the same in principle as that invented by the people who taught Northern Europe the arts of industry.

To prepare the pigment, the purest metallic lead is obtained. Originally it was subjected to the chemical operation in the form of loose rolls of sheet lead. The American method is to cast the lead into circular gratings looking very much like shoe buckles. In whichever shape prepared, the lead is put into earthen jars, with a little vinegar at the bottom, the lead being supported by earthen ledges from coming into contact with vinegar. Sometimes the pots have openings in the sides to permit a free circulation of the vapors set free in the process. An immense collection of the jars, tens of thousands in number, is then packed in alternate layers with layers of some fermenting material which will give out carbonic acid gas. Originally stable manure was employed. Now tan bark is preferred. The layers of jars and bark are carried up sometimes twenty feet high, the bark being kept out of the jars by sheets of lead and by boards. A large building being filled in this way is then closed. The fermentation sets free a large quantity of carbonic acid. Basic acetate is first formed on the surface of the lead in the pots, which is decomposed by the carbonic acid gas, forming carbonate and free acetic acid. The latter acts again on the lead. Very little vinegar is required; and the process goes on continuously, assisted by the heat of the fermentation, until, at the end of ten or twelve weeks, fermentation stops. The process is then at an end. The stack is taken to pieces, and the lead is found in its original form, though increased in bulk and weight, and converted into a very white and soft carbonate. If the conversion has not been thoroughly done, a can of metallic or blue lead will be found in the interior of some of the pieces. The pieces of lead are now thrown into large tanks filled with water, in which they rest upon shelves of copper full of holes. They are beaten to separate and pulverize the carbonate, the water preventing the fine dust from poisoning the air and injuring the workmen. Grinding and washing in water then follow, until the carbonate is reduced to an impalpable powder. It is then dried in steam pans or upon tile tables, and put up for the market. The carbonate obtained in this way is superior to that obtained in any other; but a very fair article is made by boiling solutions of nitrate or acetate with litharge, and precipitating the solution with carbonic acid. White lead is not alone employed as the best white paint; but it constitutes the body of almost all other paints, it being colored by intermixture with other pigments.

Chrome yellow is obtained by precipitating a solution of nitrate of lead with chromate of potash, and washing and drying the product. The red, a bright powder, is obtained from the yellow by boiling it with lime or some other alkaline; also by digesting levigated litharge, by boiling with neutral yellow chromate of potash, etc. A green lead is also made.

Considering how far a pound of oil paint goes in coloring a house or fence, the consumption of pig lead in paint making must be regarded as enormous. It now amounts in the United States, yearly, to about 50,000 tons. Notwithstanding the cheapness of lead paint, it is largely adulterated for the market, by small dealers, with sulphate of baryta. This is absolutely white and is not easily affected by gases, but it does not make so brilliant a paint.

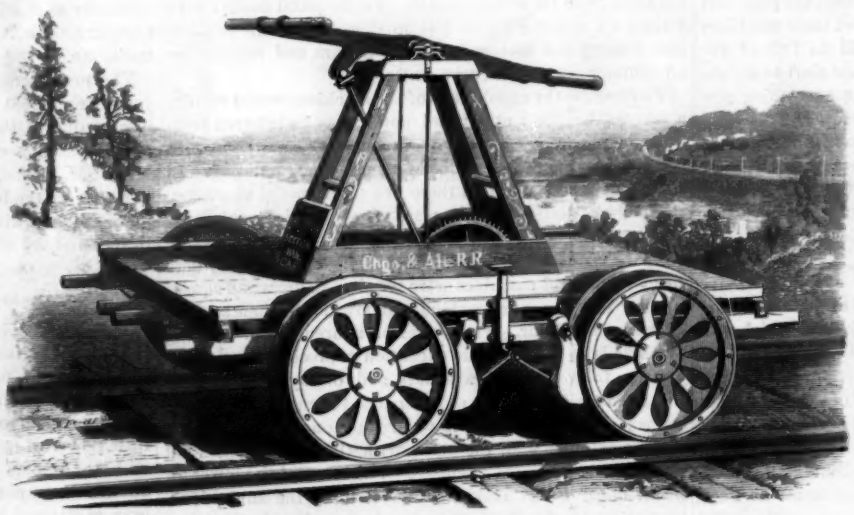
Litharge, frequently alluded to above, is protoxide of lead, produced by exposing melted lead to a current of air. It fuses readily, and, on cooling, forms a mass consisting of glistering, semi-transparent, yellow or reddish yellow scales. It generally contains more or less red lead, whence the variations in its color. It is used in the composition of flint glass.

Solar Cannon of the Palais Royal.

Strangers in Paris who have happened to be in the garden of the Palais Royal at noon on a fair day, will have noticed groups of persons watching intently at a not very conspicuous object in the garden, but all eyes seem turned toward it. The object which attracts their attention is a small cannon of antique pattern, which is automatically fired at midday by the arrangement of a sun glass so adjusted as to concentrate the sun's rays upon the priming powder, and produce an explosion at exact noon. Referring to this little cannon *L'Astronomie* says it dates from a greater antiquity than is generally known. It thundered during the Commune, under the Empire, during the days of '48, under Louis Philippe, under the Restoration, during the wars of the Grande Armee, during the guillotines of the Reign of Terror, on the day when Camille Desmoulins harangued the people, under Louis XVI., under Louis XV. In his charming "Journey from Paris to St. Cloud, by Land and by Sea," published in 1751, Néel makes his young tourist regulate his watch by it. The pillar on which it is fixed stands at the point where, in 1641, a year before his death, Cardinal Richelieu established a bound between the manors of St. Honoré and of the Archbishopric.

SHEFFIELD SECTION HAND CAR.

The Sheffield patent section hand car shown in the engraving is superior in many points to other section hand cars now in use. It is made light, yet very strong and durable.



SHEFFIELD SECTION HAND CAR.

It is easy to handle, and at the same time serviceable. The walking beam or hand lever of this car is of wrought iron, and is connected to the drive gear by a rod provided with devices which enable all lost motion to be readily taken up.

The rock shaft of the walking beam is removable and adjustable. The crank shaft is attached to the crank by a new method which dispenses entirely with the use of the ordinary key and key way, thus obviating all trouble relating to that style of fastening. The axles, 1¼ inches in diameter, are made from the best open hearth steel, and run in brass boxes.

The construction of the brake is readily understood from the cut. It brakes both wheels, and is very efficient. The wheels are made under a patent granted September 5, 1882, and combine lightness with great strength and durability.

Though placed on the market less than six months ago, this car has already gained great popularity, and has been adopted by such roads as the Chicago and Atlantic, Central Iowa, and many others.

For further particulars address the Sheffield Velocipede Car Company, Three Rivers, Mich.

Heavy Rainfalls.

It is a heavy rain in this latitude when an inch of water falls in one day, yet this amount is occasionally exceeded. According to the Signal Service Bureau, the greatest falls in the last twelve years have been as follows:

March 24, 1871, 2·37 inches; July 26, 1872, 3·80 inches; August 21, 1873, 2·24 inches; September 17, 1874, 2·41 inches; August 12, 1875, 3·34 inches; March 25, 1876, 3·45 inches; October 4, 1877, 4·2 inches; August 1, 1878, 2·39 inches; May 19, 1879, 1·11 inches; July 22, 1880, 1·81 inches; March 19, 1881, 2·40 inches; September 23, 1882, 6·17 inches.

A FEW weeks ago, during a heavy storm, the Rio Grande River suddenly changed its course by cutting through a bend near Camargo, and thus placed several acres of inhabited territory within the legal limit of the United States.

A Nitro-Glycerine Factory.

Near the village of Tweed, Ontario, and at the water's edge of Stoco Lake, is a fair sized, unpretentious, isolated, wooden building, the appearance of which would cause a stranger to inquire why such a good building was erected in such an isolated locality, and why it was so closely guarded, as a solitary watchman, day and night the year round, checks the steps and inquires the business of the curious as they stray near. As the eye passing upward reads "Nitro-glycerine factory, very dangerous!" in big letters above the door, the use for which the building is intended and the necessity for watchful care over it is apparent. At the door were seen lying iron casks sheeted inside with lead, and in these casks are imported the pure glycerine and mixed acids used in the factory.

A cask of mixed acid is hoisted by machinery to the upper story and dumped into a mixing tub, in which the mixing blades are moved by a crank turned by a man who is stationed in a tight box and has in front of him a thermometer. As the glycerine runs into the acid, a vapor is engendered in which life is scarcely supportable, hence the man turning the crank is stationed in a close box. The acid and glycerine in their admixture rapidly heat, and the compound has to be toned down by cold water or ice, hence the greatest watchfulness is necessary at this point; as the heat is allowed to run up to 80°, and as nitro-glycerine explodes at 90°, there remains but 10° of heat between the known and eternity, or, as the manager remarked, if the heat was allowed to run up to 90° they would not have time to pucker their mouth to say good-by.

It is needless to say that, while the work is going on, strangers are never allowed to enter the building, as it is necessary that every man should have his individual attention at such times upon his work. "Strict rules govern our men," remarked the manager, "as the least venture at experimenting would leave no one to tell how the accident happened." The nitro-glycerine thus manufactured has an explosive force ten times greater than that of blasting powder, and is used on very heavy work, but we sell very little in that shape, remarked the manager, as it is run down a tunnel to the room below, where it is manufactured into dynamite, dualin, or vigorite, all of which have nitro-glycerine as their basis, but are known by different names to designate the degree of power. As rapidly as possible the nitro-glycerine is mixed with charcoal, wood pulp, or other mixtures, and reduced into a commodity more readily handled; for although dynamite is understood to be extremely dangerous to handle, it is rammed into the cartridges with a stick, with as little apparent fear of the result as would be the case were the substance so much dirt.

The cartridges are made to hold from a pound to two pounds each, and are carefully packed each day and taken to an isolated magazine owned by the company. The output of the factory is about 1,000 pounds daily now, but the owners expect shortly to increase the capacity to meet the requirements of a rapidly increasing demand, as this is the only factory of the kind in Ontario, and the development of the mines has rapidly increased the demand, as blasting with powder has been almost entirely superseded by the use of dynamite, which is not only more efficacious, but also safer to handle. The manager remarked: "I have to pay my men large salaries, although the work is comparatively light, as a very slight accident would put them out of the way of drawing their salaries. I have worked at the business for the past seven years, and own a mill in Algoma as well as this one here, but in this business life is the result of vigilance."—*Manufacturers' Gazette.*

How to Stop the Echo.

A subscriber in Mississippi writes: "We have a large hall in this city, one hundred feet by fifty, twenty feet from floor to ceiling; the echo is so great that conversation cannot be understood. We have tried stretching wire across the hall, but it does not have the desired effect."

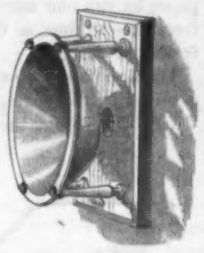
Where the rectangular form of a hall cannot be changed to advantage or economically, much may be gained by hanging draperies at the ends of the room for preventing reverberation. The rostrum should be placed in the middle of one side of the room for the best effect. This arrangement is supposed to break up the reflected waves of sound, which is the cause of reverberation.

Our correspondent might make a trial by hanging a few pieces of cheap goods upon the end walls.

SINCE referring to the death of Mr. Desnos a few weeks ago in these columns, we learn that Madame Desnos will continue the business established by her late husband at 11 Rue Magenta, Paris. Mr. Chassenent will have the direction of the engineering department, and Mr. Guion is advanced to the post of administration director, as well as secretary. The latter position he held under Mr. Desnos for more than twenty years.

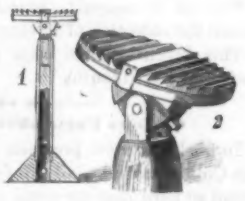
Mechanical Telephone.

This telephone allows the operator to remain in the same position while giving and receiving messages, so as to avoid the necessity of alternately applying mouth and ear to the instrument; and it eliminates the reverberations which take place in telephones in which the diaphragm is inclosed. The diaphragm is of dish form, made from a single piece of thin metal pressed or spun into shape. The bottom or base of the diaphragm is flat. Its sides are concaved outward from the bottom, and their outer edges are formed with a narrow rim. A call button is fitted at the center of the diaphragm, and the line wire is connected to the button and passes through an aperture in the base. The instrument is to be attached to the wall. A similar instrument is to be placed at the point to which it is desired to communicate, and the two connected by the line wire, which is to be drawn tightly. The call button is struck with a pencil or other hard substance, and the speaker, standing in front of the instrument, talks directly into the dish-shaped diaphragm. The hearer stands in the same position. This invention has been patented by Mr. Harvey E. Huston, of Monticello, Ill.



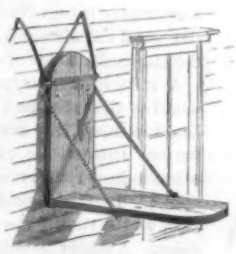
Improved Peg Cutter.

This invention is an improvement in the class of peg cutters or floats mounted on a fixed standard, and having a device for maintaining the cutter proper in the required angular position. The hollow iron standard is screwed into a fixed base. The plate that carries the cutter is attached to a bar that is free to slide vertically in the upper end of the standard, its movement being limited in each direction by means of an abutment or stop-piece that enters a slot in the bar. The latter rests on a spiral spring whose tension may be adjusted by means of a set screw. The cutter is detachably connected with the plate at the top of the bar by means of spring clamps attached to its sides and fitting in notches formed in the corresponding edges of the plate. The object of making the cutter removable is to enable the plate at the top of the bar to be used for clinching nails in the heel or toe of a boot or shoe. As an additional means for preventing movement of the cutter in any direction parallel to the surface of the plate, it is provided with a pin, which projects from the center of its under side and enters a hole in the plate. This instrument has all other required adjustments, and is strong and serviceable. Further information may be obtained by addressing the patentee, Mr. William R. Stringfield, of Pineville, Mo.



Portable Scaffold.

The engraving shows a new folding scaffold which can be held to a house, bridge, tree, bridge post, mast, etc., at any desired height, and will form a safe and reliable platform for the laborer. The invention consists of a vertical board provided at its lower end with a stirrup, between which and the lower end of the upright board the end of a horizontal board is placed, which horizontal board is braced by chains attached to the vertical board. Grabs or hooks for holding the vertical board in the desired place are attached to the upright board. This invention has been patented by Mr. Robert M. Googe, of Fleming, Ga.



Rain Water Cut-off.

This is a cut-off attachment to rain water conductors leading from the house to the cistern, the object of which is to prevent the introduction into cisterns of impurities from the roofs of houses by receiving the first washings containing the impurities, and allowing only the pure water to enter the cistern. It will be readily understood by reference to the engraving that the first washings from the roof in a shower will fall into the smaller receptacle, taking along the dust, leaves and other deposits on the roof, also any stagnant water that may be trapped in the eaves troughs, all of which pass off with the first washings. When this receptacle fills, the pure water will then pass on into the cistern. When the shower is over, or at any time before another rain, the first receptacle may be drawn off by the cock, to be ready for the next rain. A hand hole is also provided in the lower end of the receptacle, for convenience in removing any matters that may settle therein. The water collected in the first receptacle will be useful for many purposes about a house and garden, and will not therefore be lost. Of course, the cistern and the smaller receptacle may be placed in the cellar or underground if desirable. This invention has been patented by Mr. George Lemle, of 169 Baroune Street, New Orleans, La.

Improved Washing Machine.

We give herewith an engraving of an improved clothes-washer recently patented by Messrs. Robert J. Biggerstaff and Leonard Hilpert, of Blanchard, Iowa. The machine is provided with a perforated cylinder, C, inclosed by a tub, A, provided with a an open cover. In the perforated cylinder there is a conical plunger, F, which is operated by a lever at the top of the machine. In using the machine a suitable quantity of soap and water is placed in the tub, A, and the clothes to be washed are placed in the perforated hollow cylinder, C. The plunger, F, is then placed in the cylinder, C, and is worked up and down by the lever. This machine, although very simple, is claimed to be more effective and more rapid in its operation than the more complicated and more expensive devices.

Oven Thermometer.

The object of this invention is to provide an improved combined clock and thermometer to be attached to cooking stoves and ranges and bakers' ovens, for the purpose of indicating the heat in the oven and the time the article is exposed to the heat in the said oven.

The invention consists in the combination of a clock attached to the upper end of a thermometer casing. The latter and the clock are combined with a cooking-stove, and arranged in such a manner that the lower end of the thermometer casing projects into the oven, and the clock is above the top of the stove, so that the thermometer will indicate the number of degrees of heat in the oven, and the clock will show the length of time the article is exposed to the heat in the oven.

The inventor has published a "Scientific Cooking Instructor and Key" to be used in connection with the above described improvement. In this key is given the required temperature for cooking or baking the articles, and also the number of minutes or the time that the said articles must be exposed to the heat. The articles can thus be cooked or baked without once opening the oven door to ascertain the condition of the article. This invention has been patented by Mr. Joseph C. Waller, of Plattsburg, N. Y.

A Business Man's Travels Abroad.

Andrew Carnegie, Esq., of the great Pittsburg iron firm Carnegie Brothers, has recently written and published for private circulation a very entertaining volume of travels in England, under the title of "Our Coaching Trip."

As the title implies, the author relates his experiences in coach traveling with a party of friends whom he had selected for his traveling companions, and whose names be familiarly uses in relating incidents of the journey.

The excursion was by coach from Brighton to Inverness; but the author does not confine his description of events to his travels by land alone, but he relates some amusing incidents which occurred on shipboard from New York to Liverpool. Mr. Carnegie is very practical as well as facetious, and his book contains a great deal of information that should not be confined to the few friends into whose hands the book may chance to fall.

Referring to the character and ability of the men in charge of the Cunard steamships, it is probably not generally known what small wages these brave, intelligent, and capable men get for their services. According to Mr. Carnegie, the captains of these magnificent ships, with the responsibility of providing for the comfort and safety of several hundred persons, receive only $3,250 per annum; the first officer, $1,000; the second, third, and fourth officers, $600 each. The chief engineer, a man capable of controlling and keeping in order, in all weather, the ponderous machinery of the Servia, receives $1,250 a year, and the firemen at work down among the coal bunkers, amid stifling coal dust and almost intolerable heat, shoveling into the capacious furnaces one hundred tons of coal per day, receive only $30 per month.

Mr. Carnegie, referring to the advance which has been made in ocean navigation during the last twenty years, in the matter of speed, cost of transportation, etc., makes the following comparison: The Persia, once the favorite ship of the Cunard line, required the expenditure of $35 against her successor, the Servia, $1; in other words, the latter will carry thirty-five tons of cargo across the ocean for what one ton cost on the Persia twenty years ago; and so in every other department of a steamship's economy; such improvements have been made in their construction and machinery as renders the carrying of our products so much cheaper than formerly as to seriously impair the prosperity of the English farmer.

A Costly Cellar.

The cellar under a block of apartment houses, now building on Seventh avenue near Central Park, resembles a great quarry. In some parts of the block the rock towered twenty-five feet above the adjacent street level, necessitating an excavation thirty-six feet. The grade of the cross streets is such that in the length of the building, 425 feet, there is a rise of fourteen feet in Fifty-ninth street and nineteen feet in Fifty-eighth street. Consequently, the level of the parlor floor, which is seven feet above grade at Seventh avenue, will be twenty-one feet above grade at the eastern extremity of the building, and in the four houses toward the end will be the second story. The houses are spoken of as separate, and they practically are so, but in appearance they will all form one structure, arched colonnades connecting and binding them together.

The cellar starts four feet below the grade at the eastern end, and is eighteen feet below grade at the western—that is, for a space 405x200 feet. Around this is a vault under the sidewalk, fifteen feet wide, at a uniform depth of sixteen feet below grade, to afford perfect drainage as well as to give space for boilers and coal storage. The central tunnel, entered from the eastern end, will have a depth of twelve feet in the clear below the courtyard, and its floor at the entrance will be only six feet below the grade of the cross streets at that point. By this tunnel access will be given to the servants' and freight elevators. Messrs. Hubert & Pirrson, the architects, the *Sun* says, estimate approximately the total amount of rock removed at 45,123 cubic yards, which, at $2.50 per cubic yard, the ordinary price for such excavation, would bring up to $112,800 the cost of merely digging this big hole. The foundation walls required to support the ten story construction to be reared upon them, the cementing, etc., will increase the expense of this cellar by about $320,000, so that the total cost up to the top of the cellar wall will be not less than $430,000.

Improvement in Chimneys.

The best chimneys are made by inclosing hard baked glazed pipe in a thin wall of bricks. Such chimneys will not only draw better than those made in the usual way, but there will be less danger from "defective flues." A four-inch wall of bricks between us and destruction by fire is a frail barrier, especially if the work is carelessly done or the mortar has crumbled from the joints. To build the chimneys with double or eight-inch walls makes them very large, more expensive, and still not as good as when they contain the smooth round flues. To leave an air chamber between them for ventilating, is better than to open directly into the smoke flue, because it will not impair the draught for the fire, and there will be no danger of a sooty odor in the room when the circulation happens to be downward, as it will be occasionally. The outside chimney, if there is one, should have an extra air chamber between the very outer wall and the back of the fireplace to save heat, a precaution that removes to a great extent the common objection to such chimneys. A very large per cent of fires comes from defective chimneys.

New Safety Lamp.

M. Tricot, the Manager of the Mons Gas Works, at the recent meeting of the Association des Gaziers Belges, described a new fixed lamp, invented by M. Lechien, for burning safely while surrounded by an explosive mixture of air and gas, such as may be present in gas works. It consists of a metal bracket (with an orifice in connection with a pipe leading a supply of pure air from a safe distance) securely fixed to the wall, and provided with a groove, filled with sand for receiving a projecting collar at the bottom of the lamp, so as to form an air tight joint. In the bottom of the lamp is a valve, opening inwards, which keeps it closed until placed in position, when it opens automatically. The cover, made separate for facility of cleaning, is also provided with a sand joint, and the trunco-conical chimney is of such dimensions that no air or gas can enter the lamp by its means; while a sheet of perforated metal or wire gauze, placed across it, affords an additional safeguard. When the source of light is a vegetable or mineral oil, the lamp has simply to be lighted, in a pure atmosphere, before being placed in position, as it contains sufficient air to support combustion for two or three minutes, when the air valve opens. When ordinary coal gas is used, the simplest method is to light a small piece of taper near the burner before fixing the lamp and making the connection with the gas supply pipe; or the gas may be lighted by electricity, or by a fulminating capsule.

PROTECTOR FOR BUILDINGS.

A novel device for protecting buildings against destruction by storms has been patented by Messrs. Ezra Crowell and Elisha C. Dawson, of Dawson, Neb. This apparatus is designed as a temporary or permanent attachment to a building for preventing it from being blown over during wind storms, and to protect it from lightning. As will be seen by reference to the engraving, the building is secured by wire ropes of suitable strength passing over the house and connected with threaded rods extending into the earth, and secured to suitable anchorages. The tension of the ropes is adjustable by means of the nuts on the rods, which permit of putting on or taking strain off from the ropes, or of removing them altogether, as occasion may require.

The building is provided with brackets at the side, and with a saddle at the top, over which the wire cable passes. These bearings for the cable are placed in the vicinity of the corners of the building, or otherwise located over the end

APPARATUS FOR PROTECTING BUILDINGS.

framing and studding of the structure, where the strain is greatest.

A lightning rod point attached to the saddle permits of utilizing the cables and anchorages as a protection against lightning.

This invention is especially adapted to the portions of the country periodically visited by wind storms, and its adoption will preserve many buildings from destruction, and prevent loss of life and bodily injury during such storms.

BOYS' POWER METER.

We annex engravings of a new form of engine power meter which has been recently designed by Professor C. Vernon Boys. The object of the engine power meter is to find automatically the amount of work done by steam or other fluid under pressure, such as gas, water, etc., upon the piston of an engine, whether single or double acting, and to record the result on a dial during any period of time, so that the total amount of work done in one or any number of strokes may be found by inspection and without calculation.

As in an ordinary indicator, there is in the apparatus illustrated a piston controlled by a spring, the displacement of which is a measure of the steam pressure in the cylinder of the engine at every moment. When used with a double acting engine, if the total work is required, each end of the indicating cylinder is connected with one end of the cylinder of the engine, so that the displacement is a measure of the difference of pressure or the effective pressure. To find the work done, this varying pressure must be integrated with respect to the motion of the piston of the engine. In the ordinary indicator the process of integration is represented by a "diagram," the area of which is a measure of the work. In order to make the diagram on a sufficient scale, the motion of the piston is multiplied. Now the inertia of the piston alone, which cannot be obviated, tends to slightly modify the diagram, but that of the parallel motion and pencil, light though they be, has a greater effect than is often supposed, owing to the fact that the energy of motion varies as the square of the velocity.

In the engine power meter there is no multiplication of motion, and all errors due to this cause are removed. Instead of having to move a pencil at a higher speed than itself in contact with paper, all the work that the spring piston has to perform is to turn an excessively light and delicately mounted disk on a swivel axis more or less in accordance with the movement of the piston, a motion in which sliding friction is absent. This disk rests against a cylinder, which is capable of moving longitudinally on its axis, but which, if turned, causes the axis to revolve also. The cylinder is moved longitudinally on its axis in time and in proportion to the motion of the piston of the engine. The plane of the disk is parallel to the axis of the cylinder when the spring piston is in its normal position, in which case longitudinal movement of the cylinder is unaccompanied by rotation, for the little disk rolls straight along it; if, however, in consequence of steam pressure, the disk is inclined, it will tend to run in a spiral line round the cylinder, thus causing the cylinder to rotate to a proportionate amount. Now the rate of rotation of the cylinder is directly proportional to the rate of its longitudinal motion multiplied by the tangent of the inclination of the disk; or, as the longitudinal motion of the cylinder is directly proportional to the piston of the engine, and the tangent of the inclination of the disk to the effective pressure, and the product of these two is the rate of doing work, the rate of rotation of the cylinder is at every moment directly proportional to the rate at which work is being done in the cylinder of the engine, and the number of turns recorded on the dial is a measure of the total work done.

In theory the instrument depends nowhere on approximations. It is mathematically perfect in every respect. In practice it is exceeding simple. The one adjustment that might be expected to be important and troublesome, viz., making the plane of the disk parallel with the axis of the cylinder when there is no steam pressure, is of no consequence whatever, for if it is not parallel, any error that may be made during a forward stroke is absolutely removed during the return stroke, because the tangent of the angle is as much too great in one as it is too little in the other, and therefore no accumulating error can result.

As constructed, the calculating mechanism is inclosed in a box separated from the indicating cylinder by an air space, and is so protected from injury by dirt and heat. One spring can be removed, and replaced by another instantly.

Our illustration is a perspective view of the instrument, showing the dial plate on the left, the spring cover at the top, and the integrating mechanism within, part of the casing being shown broken away. The axis of the cylinder carries the first index on the dial plate.—*Engineering.*

FIG. 1.

BOYS' POWER METER.

One of General Washington's Patents.

We were recently favored with an inspection of an original patent, which ranks among the earliest documents of the kind that were issued by the United States. We allude to the letters patent granted on May 4, 1796, to Peter Zacharie, of Maryland, for a new and useful mode of making nails and brads from cold iron. A good description of the machine is given in the patent, and the inventor says he can make with the machine eight millions of nails a day. Pretty good for 1796. The patent is written upon parchment in a large clear hand. The front page bears, in large type, an official certificate of the fact of the granting of the patent, the wording being almost identical with the official form that is to-day used by the Patent Office. At the bottom of the certificate is the well-known bold signature of George Washington, President; it is attested by the signature of Timothy Pickering, Secretary of State; and is countersigned and certified by Charles Lee, Attorney-General. It is dated at Philadelphia, which was then the seat of government.

Taken altogether, it is a most interesting old document. It was shown to us recently by Mr. R. S. Chilton, formerly (from 1849 to 1851) librarian of the Patent Office. He now resides at St. Catharines, Ontario, but was appointed from New Jersey.

AUTOMATIC FLY FAN.

The engraving shows a novel spring-actuated fly fan for driving flies from the table or from a sleeping person or invalid. The spring mechanism in the base of the apparatus revolves the vertical spindle, which carries two jointed arms, each having at its outer extremity a swivel for receiving a paper flier like those in the foreground of the engraving.

These fliers may be cut from ordinary plain or fancy paper by any one according to taste, and may be renewed from time to time, so that the wings of the fan are always fresh and clean.

The arms may be extended more or less, and as they are revolved by the spring gearing, the fliers are revolved on the swivels, giving the apparatus a very curious appearance.

COFER'S AUTOMATIC FLY FAN.

The fan is compact, ornamental, and inexpensive, and avoids the objection of having dirty, unsightly wings.

This invention has been patented by Mr. Thomas W. Cofer, of Portsmouth, Va.

Curious Facts about Precious Stones.

In his lecture on precious stones, Professor Egleston, of the Columbia School of Mines, says there is in Paris a diamond so hard that the usual process for cutting and polishing made no impression upon it. The black diamond is mostly used for tools. In Russia it is broken into flakes, polished, and worn as court mourning. The historic diamonds have no more luster than a piece of glass. The sham diamond was more beautiful than the genuine stone, but it has a tendency to decomposition and does not retain luster.

The diamond mines of Brazil were first opened in 1727. It is estimated that since that time they have produced at least two tons of diamonds. In England, a stone weighing one carat and of the purest water is worth, when cut and polished, about $60. The dealers in rough stones acquire the habit of distinguishing the water of a rough stone by simply breathing upon it. Among the historic diamonds, the Rajah weighed 367 carats, and the Great Mogul 280. Before it was cut the latter weighed 900 carats. From the composition of the diamond we see what costly things Nature makes from common material. All the diamond fields of the world are not worth the anthracite fields of Pennsylvania.

A ruby of five carats is double the value of a diamond of that size, and one of ten carats is worth three times as much as a diamond of corresponding size. A perfect ruby is the rarest of all stones. Rubies are often imitated with real stones, the most common being spinel. But it is not difficult to distinguish the imitation, as the ruby is the only stone having a pigeon blood color. Another precious stone is the sapphire, which is like the ruby, with the exception of the color. He had seen a small stone which was ruby on one side and sapphire on the other. The emerald is a deep green, the deeper the better. It loses no brilliancy in an artificial light, but its color may be expelled by a gentle heat.

Most of our emeralds come from New Granada, and will always have flaws. In imitations it is not the hardness nor the color that is sought, so much as the flaw. The first eye-glasses were made in England of emeralds.

Bands from Sheep's Entrails.

The mode of manufacturing bands from sheep-guts is described as follows in the *Shoe and Leather Reporter:* The entrails, which are about 15 yards long, are well cleaned, and laid for a few days in salt water. They are then not thicker than ordinary cotton yarn, but will bear a strain of nearly 12 pounds, and are wound upon spools like yarn. If it is required to make round bands, the procedure is the same as in the making of ordinary rope; if, however, broad flat bands are required, this must be done in a loom, and in 5 strands, as in the making of ribbon. Flat bands can be made of any size; round ones have various diameters. The round ones have either the form of a smooth cord or that of a cord of from 3 to 5 strands.

Kidd's Cave.

BY H. C. HOVEY.

During the dog days last summer, I amused myself by hunting up some of the localities linked by tradition with the name of the famous pirate, Captain Kidd. It is certain that, when hard pressed by Lord Bellomont, who finally caused him to be hanged, the pirate concealed in some safe place a vast amount of treasure! We have nothing now to do with the whimsical stories told about exciting adventures in digging for these coveted chests glittering with costly jewels, ancient coins, and solid wedges of gold. The matter of fact is that, within the memory of persons now living, excavations for Kidd's treasures have actually been made in the bank of the stream that used to run near Silver Street, in New Haven, Conn.; and the probability is that Kidd used occasionally to sail into the bay for repairs at Greenough's ship yard.

Pits are also visible on Money Island, one of the group known as the Thimble Islands, off Branford, where treasure hunters have been at work within the present century. Nearly everything, indeed, about these picturesque islands is flavored with reminiscences of piratical adventure. Kidd's Harbor lies between two of the highest rocky points, and Kidd's Punch Bowl is exhibited as a great curiosity. The latter is a natural hollow in the granite ledge on Pot Island, and is about three feet long by a foot or more in width, and the same in depth. There is no proof that it was ever used for convivial or even culinary purposes.

Kidd's Cave, however, deserves more particular description. It is one of several small grottoes in the granite ledges near Short Beach, about six miles from New Haven. Leaving the cluster of cottages by the shore, we made our way through thickets of laurel and bay to what was once the natural sea wall. Following this for three hundred yards, we came to a rift in the rocks, around which a mass of fragments lay scattered for twenty feet. Measuring the height of this wall, I found it to be about thirty feet above the sea level, and twenty-four feet above the adjacent meadow.

Some former explorer has taken the pains to paint the name of "Kidd's Cave" on the wall near the entrance, which is an opening eighteen inches wide and five feet high. The adit slopes for ten feet at an angle of forty-five degrees to a small chamber, the floor of which is encumbered with fragments. The main passage runs from east to west for twelve feet, and then turns abruptly north for sixteen feet. This measurement does not include rifts and seams that reach much farther in several directions. The height of the chamber varies from three to eight feet, and there is an opening at one place up to the surface, through which smoke might ascend as by a chimney. Remnants of fire show that the spot has been used at some time as a hiding place; though it would not be easy to tell if the refugees were pirates, Indians, or modern tramps. At one point the floor was examined for relics, and search was rewarded by the discovery of a few arrowheads and two stone axes.

The fauna of Kidd's Cave includes spiders, flies, frogs, slugs, snails, and mice. Three of the latter were caught, and were found to be specimens of the common field mouse.

The temperature in the shade near the mouth of the cave, at 4 P.M. on the day of our visit, was 74° Fahr. But, within the grotto, the mercury fell, after an interval of ten minutes, to 55° Fahr., which is only one degree above the mean temperature of Mammoth Cave, as determined by the same instrument. I regard this fact as remarkable, considering the limited dimensions of the excavation; and it confirms the opinion to which other temperature observations have led me, that the mean temperature of the earth's crust in this latitude is about 54° Fahr., both winter and summer.

The origin of Kidd's Cave was undoubtedly marine; and the probability is that it was formed at a time when the coast was considerably higher than it now is, and that the upper portion of the cave is all that is now visible. I judge thus from the fact that large masses of rock have evidently fallen from the roof into some lower cavity, where they have disappeared.

Subsidy to Pasteur.

The French Minister of Agriculture has lately placed at the disposal of M. Pasteur a new sum of 50,000 fr. ($10,000), in order to continue his admirable investigations upon the contagious diseases of animals. The government had already granted to the illustrious savant, for the same object, 50,000 fr. in 1880 and 40,000 in 1881. The minister consulted a special committee, who, in view of the brilliant success obtained by Pasteur in his previous investigations, unanimously recommended a renewal of the grant.—*Les Mondes.*

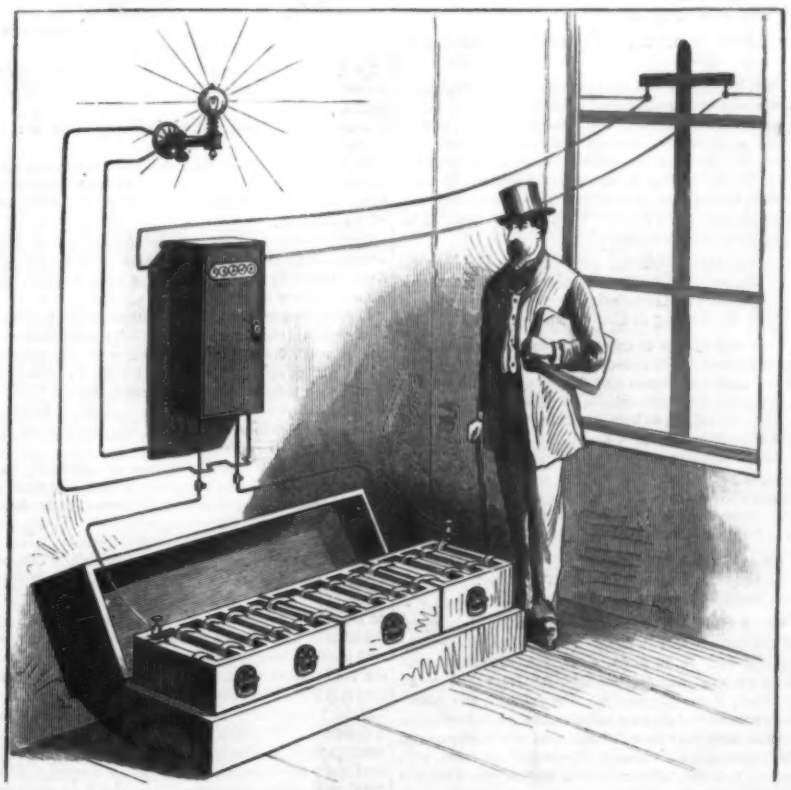
IN the eastern part of Massachusetts, and with headquarters in Boston, are seven nail mills, operating 300 machines, and turning out an average of 10,000 kegs per week, mostly for the home trade, but furnishing shipments for Cuba and South America.

THE BRUSH-SWAN ELECTRIC LIGHT.

A private exhibition of the Brush-Swan incandescent electric light was recently given at the offices of the Brush Electric Light Company in this city, and Mr. Charles F. Brush, the inventor of the system, and Mr. G. W. Stockley, the vice-president and manager of the Brush Electric Company, of Cleveland, O., gave to members of the press and electricians a general explanation of the Brush-Swan apparatus for electric lighting. The salient features of the system are

THE SWAN LAMP.

the Brush storage battery, the Brush "current manipulator," and the Swan incandescent lamp. These devices—located on the premises of every consumer—in connection with the distributing wires of the street system and generating dynamos of the district, form the complete Brush-Swan apparatus for electric lighting by incandescence. The current may be (and in the present case was) taken from the arc lamp circuit during the evening, while the arc lights are in operation, or in the daytime while the lamps are cut out of the circuit, or they may be placed in a special circuit and



THE BRUSH STORAGE BATTERY.

charged by machines set apart for this use alone; but the important features of the system are: first, to provide an unfailing supply of electrical energy, which is secured by the use of the storage batteries; and second, to utilize the arc light plant at times when it would otherwise be idle, thus virtually diminishing the interest on the investment.

The employment of storage batteries not only produces a perfectly steady light, but the uniformity of the current insures great durability in the carbon filament of the lamp.

The storage battery used on the evening referred to was charged by the current from a No. 8 Brush dynamo at the Elizabeth Street station, which at the same time furnished thirty-four arc lamps on a circuit a little over ten miles in length, the conductor being a No. 6 copper wire. The battery consisted of twenty-four elements, and furnished a current to twenty-seven sixteen-candle power Swan lamps. The carbon filament was maintained in a high state of incandescence, emitting a very steady white light.

The general appearance of the storage battery is shown in our engraving. It consists of lead plates treated by a process not explained by Mr. Brush. The plates are arranged by pairs in cells and connected up in series. Each battery of twenty-four cells is connected with the "current manipulator" fixed to the wall, and the charging current entering the manipulator is switched from one battery to another automatically by the manipulator, and when all of the batteries are fully charged they are cut out of the dynamo circuit by the same means. When either of the batteries is partially exhausted, it is switched into the charging circuit by the manipulator, and even while receiving its charge the battery may be supplying its current to the lamps, the needs of the battery being provided for by the manipulator, which also records the amount of current used.

The sizes and capacity of the cells are given below.

Size of cells.	Capacity in Swan lamps.	Size plates in inches.	Number cells required for Swan lamps.
No. 1.	5 to 8.	8 x 8.	20.
" 2.	10 " 15.	8 x 16.	20.
" 3.	20 " 30.	8 x 16 dbl.	20.
" 4.	40 " 60.	16 x 16.	20.

These batteries, we are assured, will furnish 9 to 10 lights of the size or power of an ordinary 5-foot gas burner (usually 16-candle power), for each horse power absorbed by the dynamo electric machine used in charging them.

This is an economy which we believe has not been claimed for any other system, and which is partly due to the greater efficiency of the battery, and partly to the use of a distributing and charging current of comparatively high electromotive force. This kind of electric current permits of the use of small conductors and long circuits, and is effective in charging the secondary batteries, while the batteries yield a current of low potential adapted to incandescent lighting.

As to the durability of the Swan lamp, we are informed that in the Savoy Theater, London, which is illuminated by them (the current being supplied by a dynamo), the lamps have lasted 3,000 hours. This is due, in a great measure, to the homogeneity and density of the carbon filament, and the perfect uniformity in its size and shape from end to end. This lamp, as will be noticed by reference to the smaller engraving, is similar to others of its class; the mounting, however, is different. The wires which hold the ends of the carbon, and are fused into the glass, are bent into hooks for engagement with other hooks forming the terminals of the circuit wires, the lamp being pressed downward, so as to bring the hooks into engagement by the spiral spring into which its neck is inserted.

All danger from short circuiting the lamp or wires is avoided by means of an exceedingly simply and inexpensive device consisting of a strip of tinfoil secured to the face of a piece of vulcanized fiber, the tinfoil forming a part of the circuit. When the lamp is short circuited, the tinfoil melts and is thrown off from the strip of fiber thus interrupting the circuit. The vulcanized fiber with its attached tinfoil is readily replaced.

The Brush Electric Company assert that this system of lighting is now entirely beyond the experimental stage, and that it is commercially practicable and ready for the public.

In addition to their extensive works already in operation in Cleveland, the Brush Electric Company is erecting a large building to be supplied with steam power to the extent of 1,000 horse power, for the purpose of manufacturing the new storage battery.

Headache.

Dr. Haley says (*Australian Medical Journal*, of August 15, 1881) that, as a rule, a dull, heavy headache, situated over the brows and accompanied by languor, chilliness, and a feeling of general discomfort, with distaste for food, which sometimes approaches to nausea, can be completely removed, in about ten minutes, by a two-grain dose of iodide of potassium dissolved in half a wineglassful of water, this being sipped so that the whole quantity may be consumed in about ten minutes.—*Glasgow Med. Journ.*

IT is announced that a contract has been closed between the Canada Southern Railroad Company and the Phœnix Bridge Company, for the building of a new suspension bridge across the Niagara River, a quarter of a mile south of the old suspension bridge. The new bridge is to be ready for traffic by September, 1883.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Unless you open a barrel of apples at the right end, they will be found getting steadily worse as you reach the bottom. Not so with a box of Esterbrook's Steel Pens, which are of uniformly good quality throughout.

Special Emery Grinding Machinery, Automatic Knife Grinders, Improved Stove Plate Grinders, Saw Gummers, etc. Write for cuts, descriptions, and prices. Lehigh Valley Emery Wheel Co., Lehighton, Pa.

TREASURY DEPARTMENT, OFFICE OF ENGINEER, WASHINGTON, December 6, 1882.

Messrs. H. W. Johns M'f'g Co., 87 Maiden Lane, N. Y.

DEAR SIRS: The steam pipe covering applied by you in this department eighteen months ago has proved very satisfactory, not only as a non-conductor, but for its convenience in being removed and replaced without any loss or injury. Yours, etc.,

THOS. A. GIBSON, Engineer.

H. N. Veefkind, Agriculturist and Dairyman, near Arnhem, Holland, will arrive in New York during the month of January, 1883, with a, by him, newly invented Hand Butter Churn, which excels all existing churns in the following points: Simplicity of construction, cheapness, easy operation, durability, and minimum of power required. Parties desiring to enter into negotiations for rights of single States or the United States will please communicate with the manager of the *Nieuwe en Handels Courant*, No. 25 South William Street, New York City.

Woodworking M'ch'y. Bentel, Margedant & Co., p.413. Drop Forgings. Billings & Spencer Co. See adv., p. 413.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

50,000 Emerson's Hand Book of Saws. New Edition. Free. Address Emerson, Smith & Co., Beaver Falls, Pa.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 414.

Gould & Eberhardt's Machinists' Tools. See adv., p. 414.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 414.

Barrel, Keg, Hogshead, Stave Mach'y. See adv. p.414.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

Sewing Machines and Gun Machinery in Variety. The Pratt & Whitney Co., Hartford, Conn.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 412.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 414.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Ave., Phil. Pa.

Common Sense Dry Kiln. Adapted to drying of all material where kiln, etc., drying houses are used. See p. 414.

4 to 40 H. P. Steam Engines. See adv. p. 412.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 84 John St., New York.

Scientific Books. See page 396. Catalogues free. E. & F. N. Spon, 44 Murray Street, N. Y.

Lubricator. See advt., Detroit Lubricator Co., p. 398.

See New American File Co.'s Advertisement, p. 398.

Steam Pumps. See adv. Smith, Vaile & Co., p. 398.

Engines, 10 to 50 horse power, complete, with governor, $150 to $500. Satisfaction guaranteed. More than seven hundred in use. For circular address Heald & Morris (Drawer 127), Baldwinsville, N. Y.

Brass Finishers' Turret Lathes, 13½ x 4, $165. Lodge, Barker & Co., 199 Pearl St., Cincinnati, O.

Important to Inventors.—The Anglo-American Patent Development Company, Limited, 28 Southampton Buildings, London, England, Authorized Capital $250,000, is prepared to receive applications from American Inventors to develop (by manufacturing or otherwise) their inventions in Europe. Full particulars addressed as above by Registered Letter to be forwarded, with $5.00 U. S. Currency, to cover expense of investigation, otherwise applications cannot be considered. Inclose stamp for Prospectus of Company to Messrs. Knauth, Nachod & Kuhne, Bankers, New York.

Thomas Camp, of Covington, Georgia, General Agent for the sale of Portable Steam Engines, has a trade of $250,000 per annum in that State. Manufacturers will find this the best medium in the South through which to sell such goods. None but first-class engines sold. Best of reference given and required.

Curtis Regulator, Float, and Expansion Trap. See p. 364.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 382.

The Sweetland Chuck. See illus. adv., p. 382.

Knives for Woodworking Machinery, Bookbinders, and Paper Mills. Taylor, Stiles & Co., Riegelsville, N. J.

Permanent Exposition.—Inventors' Institute, Cooper Union, N. Y. City. Every facility for exhibition of machinery, merchandise, and inventions. Send for particulars.

Cope & Maxwell M'f'g Co.'s Pump adv., page 396.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 364.

Wanted.—Patented articles or machinery to make and introduce. Gaynor & Fitzgerald, New Haven, Conn.

To stop leaks in Boiler Tubes use Quinn's Patent Ferrules. Address S. M. Co., Box 80, Newmarket, N. H.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock Mfg. Co., 30 to 36 Market St., Chicago, Ill.

To make Violins, write James Robloe, Syracuse, N. Y.

Water purified for all purposes, from household supplies to those of largest cities, by the improved filters manufactured by the Newark Filtering Co., 177 Commerce St., Newark, N. J.

Assays and Analyses of ores and all commercial products. Advice given and investigations made in all branches of chemical industry. Send for circular. N. Y. Assay Laboratory, 40 Broadway, New York.

Sheet and cast brass goods, experimental tools, and fine machinery. Estimates given when models are furnished. H. C. Goodrich, 66 to 72 Ogden Place, Chicago.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description.

Improved Skinner Portable Engines. Erie, Pa.

25" Lathes of the best design. G. A. Ohl & Co., East Newark, N. J.

Combination Roll and Rubber Co., 68 Warren street, N. Y. Wringer Rolls and Moulded Goods Specialties.

First Class Engine Lathes, 20 inch swing, 8 foot bed, now ready. F. C. & A. E. Rowland, New Haven, Conn.

Ice Making Machines and Machines for Cooling Breweries, etc. Pictet Artificial Ice Co. (Limited), 142 Greenwich Street. P. O. Box 3083, New York city.

Steel Stamps and Pattern Letters. The best made. J. F. W. Dorman, 21 German St., Baltimore. Catalogue free.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

NEW BOOKS AND PUBLICATIONS.

FORTY YEARS IN PHRENOLOGY. By Nelson Sizer. New York: Fowler & Wells, 12mo, cloth, pp. 413, $1.50.

Mr. Sizer has brought together from the notes and recollections of his long service as a phrenological lecturer and examiner two or three hundred anecdotes illustrative of his varied experiences. Many of them are amusing, and all of them are intended to enforce some social or educational lesson, or to demonstrate the value of phrenology as a guide in the affairs of life. A brief review of the principles of phrenology are given at the end.

ELECTRICITY. By Robert M. Ferguson. Revised and extended by James Blyth. London and Edinburgh: W. & R. Chambers. 3s. 6d.

The additions to this new edition of Dr. Ferguson's well known work are intended to cover the more important recent discoveries, inventions, and practical applications of electricity. The recently adopted units of electrical measurement are given and explained, and also the leading mathematical formulæ, so far as can be done without recourse to the higher mathematics.

TRAITS OF REPRESENTATIVE MEN. By George W. Bungay. New York: Fowler & Wells.

The thirty or more representative men whose characteristics and achievements are here very sketchily presented include prominent Americans chiefly, either living or recently dead. For each character there is given a characteriess portrait. Some of the engravings were originally good, but have been abused in the printing; the rest were so cut as to make them caricatures rather than of likenesses, and bad printing has intensified their wooden ugliness.

CHARLES DARWIN. London: Macmillan & Co. 75c.

This latest addition to the Nature Series embraces the memorial notices of Darwin first printed in "*Nature*." Professor Huxley furnishes an appreciative introductory notice of Darwin's life and work. Dr. Romanes discusses his life and character. Dr. Geikie reviews his work in its bearing on geology: Thistleton Dyer his work in botany; Dr. Romaines his work in zoology and in psychology. An admirable portrait of Darwin, on steel, serves as frontispiece.

HEROES OF SCIENCE. By Prof. P. Martin Duncan. London: Society for Promoting Christian Knowledge. New York: E. & J. B. Young & Co. 12mo. $1.20.

Evidently written to order, and remarkable rather for avoiding than for dwelling upon those acts and opinions of the characters named that showed any heroic quality. And there is a careful omission of all essentially modern work in the sciences—botany, zoology and geology—the earlier development of which is reviewed. The heroic period of botany appears to have ended with De Candolle, of zoology with Cuvier, and of geology with the earlier work of Lyell. Nevertheless, so far as it goes, the book is readable, and would make a valuable addition to any Sunday-school library.

THE COMPLETE GUIDE TO SILK CULTURE. By L. Capsadell, New York: W. B. Smith & Co. 25 cents.

Those who think of experimenting in the reviving art of silk culture will find this a handy and trustworthy guide book. It is plain, clear, straightforward, entirely practical, and commendably free from extravagant promises of possible results. The author is an enthusiastic promoter of the new industry, but, while furnishing specific directions as to the treatment of silk worms and their products, he is content to rest his case there, leaving the financial inducements to engage in the work to be offered by the publishers in the advertising pages. In this, as in every other industry, the beginner should bear in mind that experience and practical skill have to be paid for, and that every new industry is apt to be attended by many failures, losses, and disappointments.

MONACO. United States Game Publishing Company, Rochester, N. Y.: American News Company, Sole Agents.

This new game is played somewhat like checkers. The pieces are numbered, and the value of each when taken is the product of its number by the number of its place in the column of the captured. It is fairly interesting as a game, and may be made useful in giving young people a thorough, as well as diverting drill in simple multiplication and addition.

THE STILL HUNTER. By T. S. Van Dyke. Published by Fords, Howard & Hurlbert, New York. Price $2.00.

This is unquestionably the best book ever published in this country on the art of still hunting, or deer stalking, and is written by one who evidently thoroughly understands the subject he treats. He has made a very entertaining and intensely practical book. Numbers of men who potter away three months in a year in the insanities of watering places, when they might enjoy a month or two of exhilarating sport and healthful exercise in the haunts of the antlered monarchs of the forest, want such a book to screw up their courage to go forth and hunt. It teaches how to hunt and where to hunt, giving directions where they are needed, and wisely indicating the circumstances in which a man's common sense must be the teacher.

PRACTICAL MICROSCOPY. By George E. Davis. Illustrated. Philadelphia: J. B. Lippincott & Co.

Though this excellent treatise has reached a second edition, it is substantially a new book to American microscopists. It is thoroughly practical and profusely illustrated. The first half of the book contains little that is new, yet the chapters on staining and on reagents and recipes will be found suggestive and very useful. The author's process for the double staining of vegetable sections is particularly good, and gives beautiful results. The chapters on micro-photography are also excellent, being well illustrated and full of practical details. The test of every day use justifies a hearty recommendation of the work to the favor of microscopists.

AMERICAN FOUNDRY PRACTICE. By Thos. D. West. New York: John Wiley & Sons.

Embodies the series of practical articles on moulding contributed by the author to the *American Machinist* during the past two years, describing American methods in moulding with loam, dry sand, and green sand, the management of cupolas, and the melting of iron. Mr. West believes that to master his trade the young moulder needs something more than the brute force required for ramming sand; indeed, that there is no trade that calls for greater intelligence, skill, and care, than that of the moulder. The book is full of instruction for beginners and contains many facts and suggestions that seem likely to be of use to foundrymen of longer practice.

GYMNASTICS OF THE VOICE. By Oscar Guttmann. Albany, N. Y.: Edgar S. Werner, 12mo, cloth, $1.25.

Professor Guttmann's treatise, which has been before the English and German world for twenty years and more, has now been fully illustrated and carefully revised, materially increasing its already eminent value. Its four parts treats respectively of the anatomy of the respiratory and vocal organs, the activity of these organs in producing voice, the correct utterance of the elements of speech and song, and the art of breathing easily and effectively when speaking and singing. The work shows not only how to train the vocal organs so as to attain strength, purity, and beauty of tone, but gives abundant anatomical, physiological, and hygienic reasons for the modes of training which he advises.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

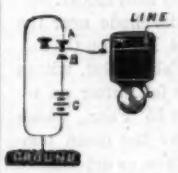
(1) P. F. M. writes: Please decide a discussion between two friends of mine. A says that if a bird sits on a telegraph wire while in operation, it will receive an electrical shock more or less intense, according to the state of the atmosphere and the strength of the current passing through the wire. B says that the bird will receive no shock at all, and to prove his assertion states that it is known in physics that a current always follows the best conductor, and that a body through which a charge is to be passed must form part of the circuit, consequently, he concludes that in the present case the bird will receive no shock, because it is a worse conductor than the wire, and because he thinks it forms no part of the circuit. A, without contradicting the alleged physical principles, argues that the living animal body is a good conductor of electricity, and that the moment a bird sits on a wire through which a current is passing it forms part of that wire, and consequently part of the circuit. A also brings in, to strengthen his assertion, the known physical fact (which he quotes from Ganot's Physics) that, when two conducting bodies are in contact, one of which is electrified and the other in its natural state, the electricity is comparted between the two in a relation proportional to the surfaces of the bodies. Finally, A, to prove entirely his assertion, refers to the fact that there are always dead birds beneath the telegraph wires. I decided the discussion in favor of A, but offered them both to get a decision from you, and expect to have it soon. A. Undoubtedly a small portion of the current passes through the bird, but not sufficient to produce any noticeable effect. The bird, being a comparatively poor conductor, forms a shunt of high resistence to so much of the wire as is between his claws. The dead birds found in the vicinity of telegraph wires are killed by striking the wires during rapid flight.

(2) E. F. L. asks: 1. How fast can an ordinary engine be run without danger? Will it do to speed them up to 800 feet per minute? A. There are many engines running to 800 feet per minute, but they must be carefully fitted and well balanced. 2. What would be the difference in power of a 6 x 12 engine running at 200 revolutions and 400 revolutions, with the same amount of steam, say 90 pounds? A. If you double the speed with the same pressure, the power will be doubled. 3. Is there any rule for the gearing up of machinery? For instance, I want to run a saw from a countershaft; does it matter how large or small the different pulleys are, so I get the desired speed? A. The larger the pulleys, the narrower belt can be used. 4. Is there a book on the planning of machinery, so as to get the most power, and where can it be had? A. There is no one book; the information is scattered through many books. 5. I see there was an engine run on some road last May by naphtha; what has become of it? Is it a success, and if so, why are they not put on the market? A. We believe that no naphtha engine has yet proved a success practically.

(3) S. S. asks: What is the best way of tinning malleable iron bright? I have seen some castings that were bright and smooth, others that were dark and rough. Please inform me of a method by which I can tin bright and smooth without extra work of polishing? A. You cannot tin malleable iron without cleaning it thoroughly in dilute muriatic acid; rinse in hot water, dip in bath of hot muriate of zinc and sal ammoniac, then cautiously in a bath of melted tin.

(4) N. T. C. O. asks: 1. In what ratio does the diameter of copper wire stand to the force (in horse power) transmitted through it from a dynamo machine? A. This depends, first, upon the kind of current used, a current of high potential not requiring as large a conductor as a current of low potential, and, second, upon the distance through which the power is to be transmitted. 2. What is the practical limit of power (in horse power) capable of being generated by a dynamo? A. The limit, if there is one, has not yet been reached. 3. What is the actual percentage of useful power transmitted at a distance, say of a hundred miles from dynamo, or general ratio of force and distance? A. See article "On the Transmission of Work to a Great Distance on an Ordinary Telegraph Wire," p. 350, current volume SCIENTIFIC AMERICAN. 4. Is it practically possible to transmit, say, two hundred horse power generated by a dynamo to a distance of one hundred or more miles? A. Yes. 5. What may be the approximate (primary and running) cost of an engine capable of producing the effect stated in question 4? A. Correspond with some of the prominent manufacturers of dynamos.

(5) C. E. E. W. writes: I notice in your issue of Nov. 25, 1882, you give in answer to question of W. P. S. (No. 1,) in regard to arrangement of two call bells on one wire with open circuit batteries, a plan in which one bell is cut out when the signal is given. Don't you think the arrangement shown in the sketch would be much more satisfactory? For by the arrangement you describe you could not tell whether the line was in working order or not except by inspection, whereas by this plan the bell will ring when the key is pressed down, in all cases, except when the line is out of order, when you would know that there was not any signal made at distant station, and that the line needed repairs. I should think W. P. S. would get more satisfaction from this arrangement. [The plan suggested by our correspondent is good for single stroke bells, and may be adopted where the sound of the bell at the transmitting end of the wire is not objectionable. The extra bell increases the resistance of the circuit, but in most cases this is of no account.—ED.]



(6) J. A. writes: Will you kindly inform me, through your Notes and Queries, how I can successfully finish small brass articles, such as tubing and thin rods? I am making a few fancy things just for home decoration, and I succeed very well until I come to the lacquering, and then, no matter how much pains I have taken to polish the brass, it is sure to look dirty after it is lacquered. Now, I want to get that beautiful golden look that you see on lamp fittings, etc. Is it possible for me to do it with ordinary lacquer and a common kitchen stove, or is there any lacquer you can tell me of, better for the purpose than that I buy at the store? A. For lacquering bright brass work, use for your lacquer half a pint 95 per cent alcohol; one ounce seed lac, or, if not to be had, the same quantity clear shellac; half a drachm of dragon's blood; half a drachm turmeric; put all in a bottle, cork tight, and shake up often for a few days, then let it settle for a few days and pour off the clear part for use. It is well to filter it. Use a fine flat camel's hair brush of a size to work quickly with (say three-fourths of an inch to one inch wide). Warm your finished work in the oven or over a spirit lamp to about the temperature of 150°, and varnish as quickly as possible, avoiding going over any part a second time. If upon a preliminary trial the lacquer appears too thick or waxy, dilute with 95 per cent alcohol until you are suited.

(7) N. C. S. writes: One of the receipts for making the gelatine printing pad includes "a little soap." How much soap to a pound of gelatine, and what kind of soap is required? A. Use ordinary hard soap, 1 ounce to 1 pound.

(8) D. L. F. asks: What will prevent glycerine from absorbing moisture from the air? Can some kind of oil be mixed with it for this purpose? A. Nothing; no oil can be mixed with it that would counteract this tendency.

(9) R. R. W. writes: I am told by practical men and of experience that hardening tools in oil, such as sledges, hammers, chisels, and picks, is proof against cracking. Please tell me the kind of oil used and the process of so doing. A. Much depends upon the selection of the steel and the treatment it receives in welding as to its final condition in hardening. Steel for sledges, hammers, and picks should be of low grade, and not the highest for chisels. If careful attention is given to hardening at the very lowest heat possible, it will insure freedom from cracks even with water. You can harden at a higher heat with oil than with water with safety and that gives a preference to oil with many. The best oil is "pure winter strained lard," although many compounds of lard, fish, and mineral oils are used for cheapness. Heat slowly in a charcoal fire and dip, moving the article horizontally fast enough to free the surface of vapor bubbles, especially in hammers.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

S. B. A.—A is quartz rock with mica. B is a chloritic gneiss, holding iron pyrites, and probably contains gold and silver. An assay of both would be advisable.—J. E. G.—It is a very pure kaolin or china clay, and very valuable to manufacturers of porcelain; its value is about $40.00 per ton in New York city.—J. L.—No. 1 is what is termed an ironsand, and composed of magnetite and menaccanite, garnet rock, and quartz. The two first are black, the garnet yellow or red, and the quartz white. No. 2 is an ordinary micaceous clay of little value.—J. W. B.—A clay slate, holding iron pyrites, possibly containing gold or silver. An assay would be advisable.

COMMUNICATIONS RECEIVED.

A Sure Preventive of Chicken Cholera, by W. H. G. Comet, by C. H. C.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

December 12, 1882.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1836, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1836; but at increased cost, as the specifications, not being printed, must be copied by hand.

Acid, manufacture of sulphuric, E. Haworth..... 268,730
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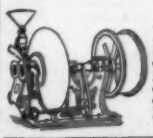

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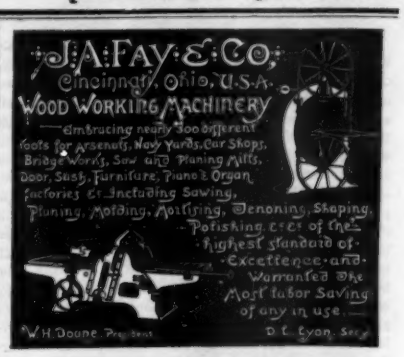

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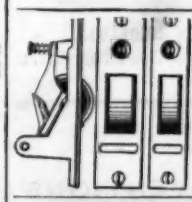

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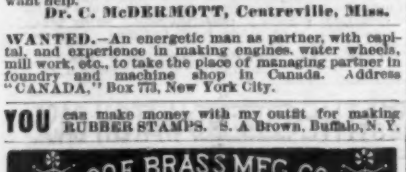

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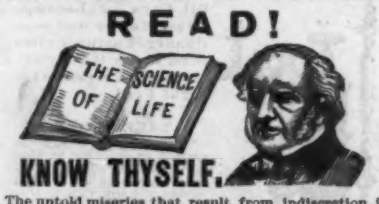

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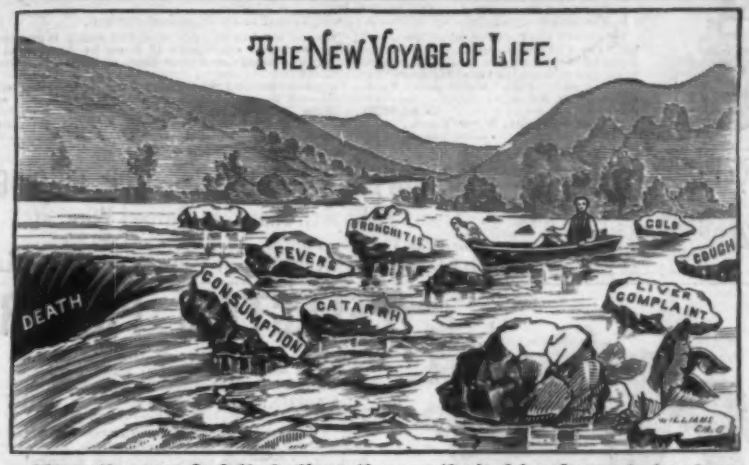

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As every breath drawn into the lungs must pass over and become polluted by the secretions in the nasal passages, it must necessarily follow that poisoning of the whole system gradually takes place, while the morbid matter that is swallowed during sleep passes into the stomach, enfeebles digestion, and often produces dyspepsia.

Catarrh Is A Dangerous Disease,

and should not be trifled with; care should be taken to look for the first indications, and cure them promptly. If your case is a bad one, affecting the throat and Bronchial tubes, producing tickling, coughing, and an almost constant effort to clear the passages, with tough, vile phlegm in the glottis on getting up in the morning, which is hard to eject, and other plain symptoms that the disease is stealing into the lungs, it should be attended to promptly and thoroughly.

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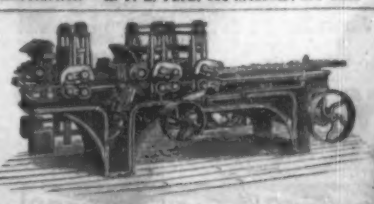

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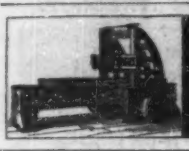

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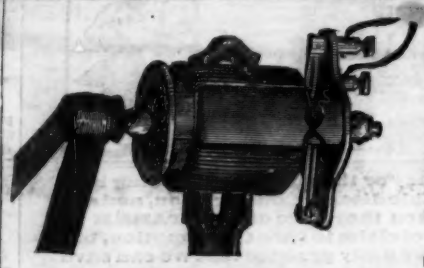

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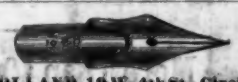

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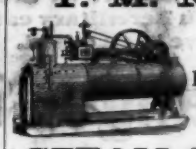

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